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ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

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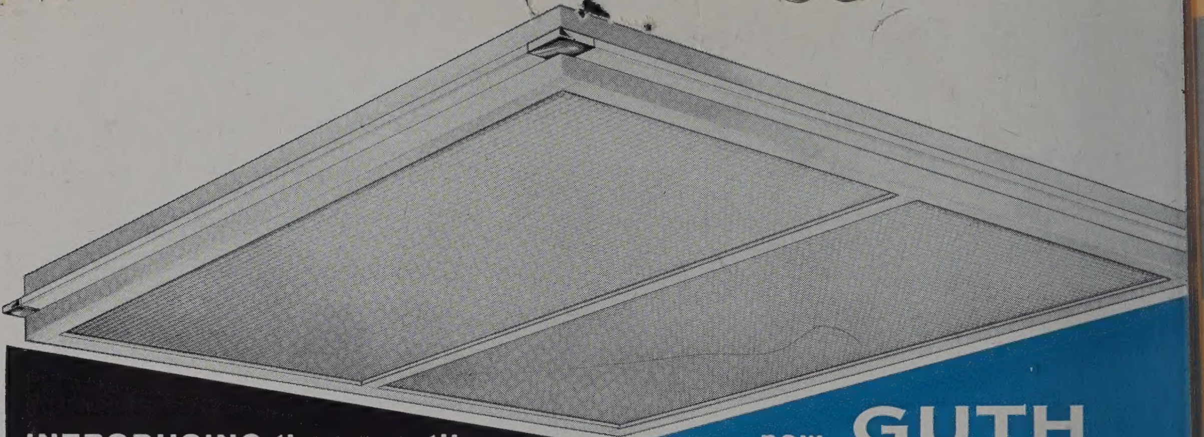
60TH YEAR



INTRODUCING the versatile...

new GUTH SURFACE MODULES

YOU PICK THE EXACT DESIGN YOU WANT...

pick a **MODULE!**

4' X 4'

1' X 8'

1½' X 8'

1' X 4'

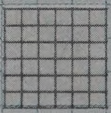
1½' X 4'

2' X 4'

2' X 8'

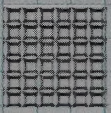
2' X 2'

pick a **BOTTOM!**



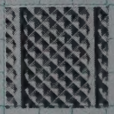
STANDARD GRATELITE*

MYSTIC GRATELITE**



PRISMOID GRATELITE†

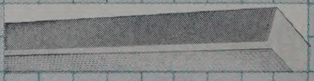
CONCAVE DROP PANELS



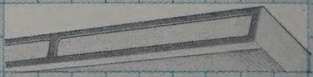
OPTILUX MARK III (solid plastic)

Plus many other popular bottom enclosures

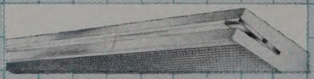
pick a **SIDE!**



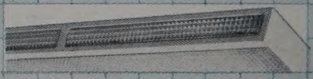
SOLID SIDES



LIGHT WINDOWS



SLIMFINS



PSGXS (Prismoid sides and bottoms)

Guth LIGHTING since 1902

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DOZENS OF VARIATIONS! All slim, trim, efficient and beautiful! Quality construction. Bottoms are hinged . . . and the hinges are hidde Super rich, *Acrylic* white baked enamel finish. I. B. E. W. made and wirec

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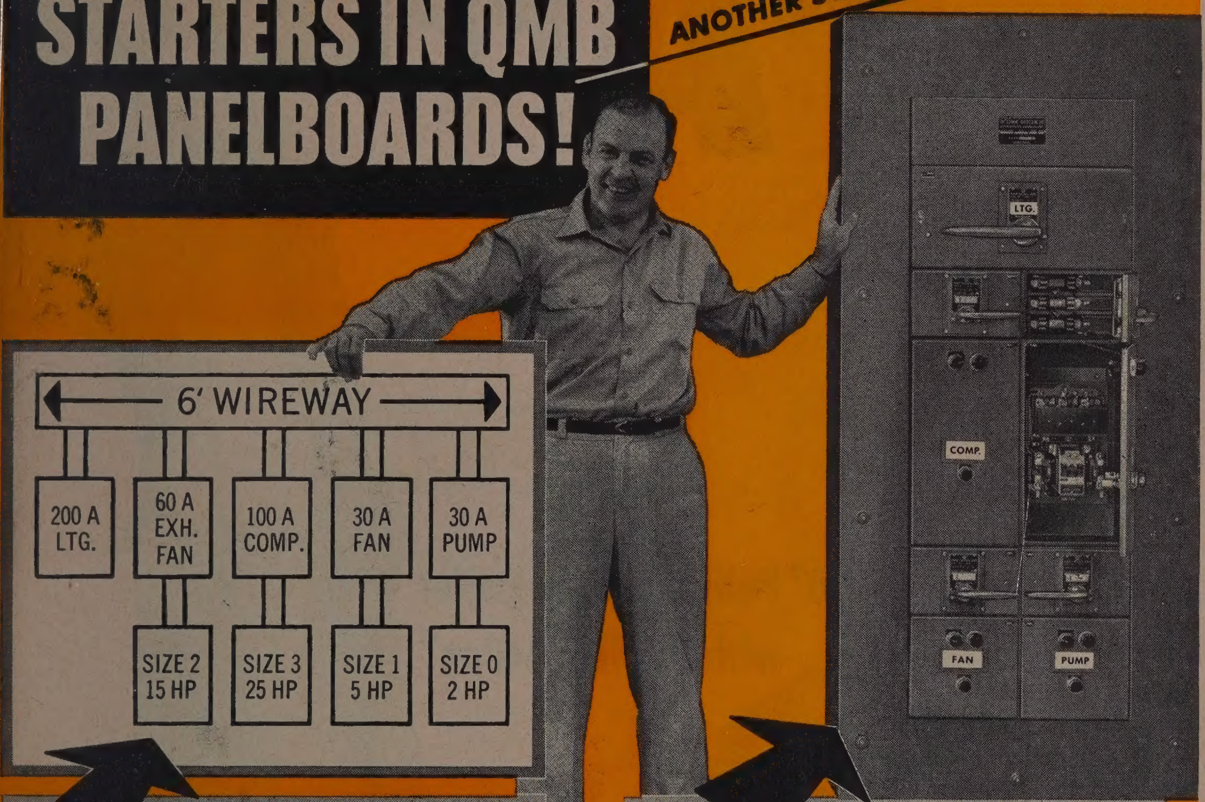
ANOTHER SQUARE D FIRST!



IT TAKES
41 HOURS AND 6 FEET
OF WALL SPACE TO INSTALL AND WIRE SWITCHES AND STARTERS LIKE THIS

IT TAKES
12 HOURS AND 30 INCHES
OF WALL SPACE FOR THE SAME INSTALLATION WITH A QMB STARTER PANELBOARD

QMB MEANS LESS TIME AND LESS SPACE PLUS

- **LOWER COST** • Time is money. The overall cost of QMB motor starters is usually less than that of separately installed starters and switches.
- **PLUG-IN FLEXIBILITY** • Plug-in switches and starters can be removed and installed in minutes. Minor circuit changes can be made without costly down time. Components easily rearranged if processes change.
- **ADDED SAFETY** • Interlocking prohibits opening starter or switch doors when switch is "ON."

QMB panelboards accommodate reversing and non-reversing starters, sizes 0 through 4. QMB switchboards and unit substations handle sizes 0 through 5. Part winding and two-speed starters available on order. All components available factory-assembled and wired. Enclosures, starters and plug-in switch units are also stocked by your Square D distributor for on-the-job assembly.

Notice how the PLUG-IN switch unit is mounted directly above the starter, permitting interlocking. The starter cannot be opened when the switch is in the "ON" position.

It's easy to order these starter and switch units. See your latest Square D Digest for further information.

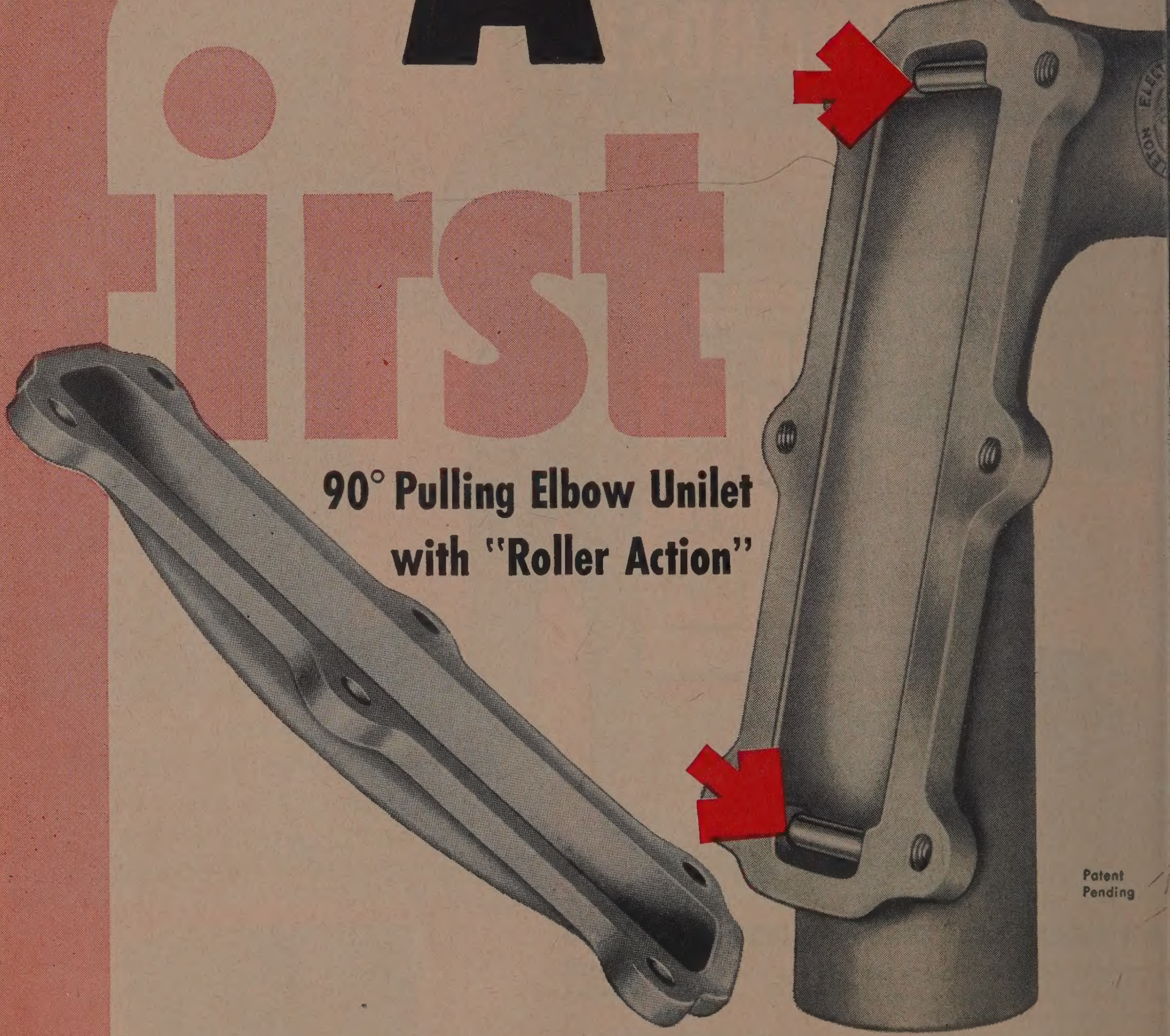
SQUARE D COMPANY

wherever electricity is distributed and controlled

from APPLETON

first

90° Pulling Elbow Unilet with "Roller Action"



Patent Pending

Explosion-Proof,* New..90° "Roller" Elbow

It's a time and cost saver for your more difficult wiring installations in hazardous locations. Large cables literally "roll through" the Appleton ELBD Unilet to give you faster, easier, lead-in wiring for motors, panel boards, circuit breakers and similar equipment.

Two, exclusive, built-in rollers guide and protect bulky cable through the chamfered hubs to complete those bulky right-angle turns WITHOUT damage to insulation or knuckles. And an all-position dome cover bolts to the precision-machined Unilet body easily, quickly to insure a totally safe, permanent, explosion-proof seal every time.

Order from your distributor now . . . Unilets available in 2½" to 4" sizes WITH ROLLERS; 1" to 2" sizes LESS ROLLERS.

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*Class 1, Group D; Class 2, Groups E, F, G

ELECTRICAL CONSTRUCTION AND MAINTENANCE

with which is consolidated Electrical Contracting, The Electragist and Electrical Record . . . Established 1901

Published for electrical contractors, electrical departments in industry, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management in the field of electrical construction and maintenance.

60TH YEAR • DECEMBER 1960

Sidelights 7

Washington Report 9

Lighting as a Heat Source, *An Editorial* 45

High-Cycle Gymnasium Lighting 47
Frequency, voltage and mounting heights are all above normal in the University of New Mexico's gymnasium, where 10-lamp fluorescent fixtures operating at 400 cycles and 600 volts are mounted 42 ft above floor level.

Personalities at NECA Meeting 52
Members and guests take over famous Las Vegas Strip and Convention Hall for 59th Annual Convention of the National Electrical Contractors Association.

Electrifying "Most Modern" Automotive Plant 55
By J. REES—Ford's new Lorain, Ohio, assembly plant employs latest techniques in electrical planning and installation including 13.2-kv distribution and ungrounded 480-volt delta secondary power.

Mobile Construction Centers Save Time 58
Mobile centers save time and provide combination field-shop, office and warehouse facilities for electrical contractor.

Luminous Ceiling Aids in Selling New Homes 60
In a four-bedroom, two-bath model home, a luminous ceiling was installed in the main bathroom for decorative display purposes. Prospective home buyers were so enthusiastic over the resultant effects that the builders decided to include this lighting with the basic purchase price of the home.

Electric Heating Forum No. 6 62
By W. J. NOVAK—The heat factor, a yardstick of heating effectiveness; don't short change heating in estimating costs.

MORE

“Home buyers will go for an improvement like that. Thanks for suggesting it!”

This is a typical comment after the Graybar man spells out a new item to help an electrical contractor.

And many are the practical suggestions the Graybar man makes in the course of his calls. For he knows “what’s cooking.” He’s wide awake to the new developments in home lighting, for example. He’s a bug on high efficiency, time-saving tools and equipment. But whether he talks entrance panels, wiring devices, tools, fixtures or other, he makes it *his* business to improve *your* business.

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It will pay you to know Graybar better. Call us. 915

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ELECTRICAL CONSTRUCTION AND MAINTENANCE

DECEMBER • 1960 *continued*

Brushes, Sparking and Machine Maintenance 66
By M. S. MAY—Some of the common machine ailments and their cures, with hints on how to obtain better brush performance.

Estimating Forum—VII 70
By RAY ASHLEY—Reduction of the standard labor unit.

Practical Methods 73
Instrument plant with 300 footcandle lighting and controlled environment; underground cable placed by ripper and tractors.

Reader Service 89
Product news announcements; catalogs and bulletins.

Reader's Quiz 115
Questions and answers on static voltage on ungrounded circuits; mounting ballasts; voltage variations; encapsulated winding repairs.

Questions on the Code 122
Answers to code questions on service switches; computing receptacle load—branch circuits; derating factors—motor branch circuits; conductor clearances; heating appliances on 30-amp circuit.

In the News 135
Report of the convention of the National Electrical Contractors Association.

Dates Ahead 151

Vol. 59, No. 12 ELECTRICAL CONSTRUCTION and MAINTENANCE DECEMBER 1960

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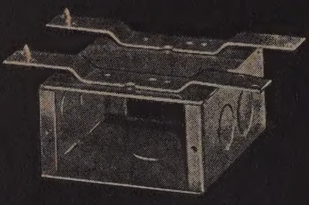
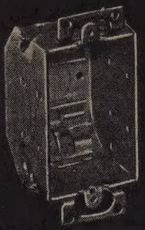
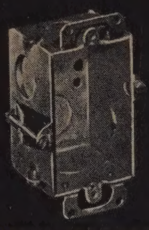


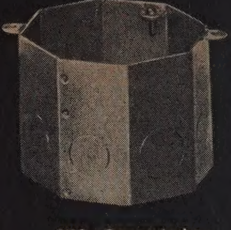
606—4" x 2"
Thru-the-Wall box



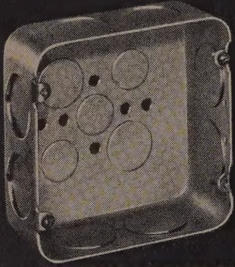
451—3 x 2" Switch box
$2\frac{1}{4}$" deep "Q" clamp



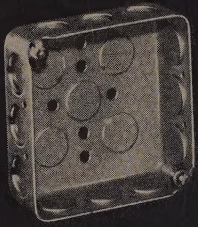
425—3 x 2" Switch box
2" deep Griptite



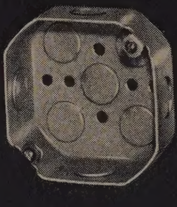
272—Concrete box
3" deep



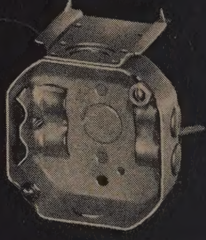
258—$4\frac{11}{16}$" Square box
$2\frac{1}{8}$" deep



190—4" Square box
$1\frac{1}{2}$" deep



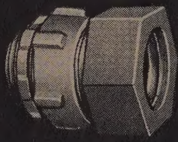
125—4" Octagon box
$1\frac{1}{2}$" deep



156—4" Octagon box
$1\frac{1}{2}$" deep N clamps

A box for every job . . .

A fitting for every need

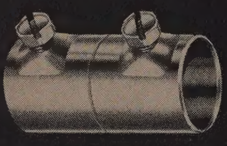


1802—No thread
rigid connector

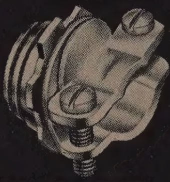
1902—E.M.T.
compression type connector

1922—E.M.T.
compression type coupling

2358—
Entrance cap

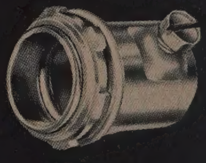


2022—Small
set screw type coupling



2141—Non-metallic
cable connector

2202—Angle squeeze connector
90° two-piece type



2002—Small
set screw type connector

Raco has the most versatile and complete line of roughing-in material you'll find anywhere. Shown here are some representative products of our extensive line. One thing is sure—whatever size, whatever type of box or fitting you require, Raco has it.

And, of course, when it comes to quality, anyone who has used Raco roughing-in materials will tell you, "there are none finer".

Write for new catalog on Raco fittings. No obligation, of course.

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ALL-STEEL EQUIPMENT INC.
Aurora, Illinois

Sidelights

EDITORIAL AWARD

Electrical Construction & Maintenance was honored by an "Award of Merit for Editorial Excellence" among industrial publications in the 22nd annual editorial competition sponsored by "Industrial Marketing." The publication was cited for an "outstanding single article" published during the 12-month period ending June 30, 1960. The winning project was "Electric Space Heating 1960," a special editorial report by Associate Editor W. J. Novak which appeared in the March 1960 issue.

HEATING FORUM

Our monthly feature "Electric Heating Forum" is designed to provide a means of industry-wide communication on electric heating practices and problems. Accumulation of the articles will provide the reader with a live and up-to-date notebook on the current progress of the field. Reprints of each of the Forums, punched for 3-ring looseleaf binding, are available at 20 cents each and an attractive binder for 12 EHF articles is available at $1.00. For EHF No. 6 see page 62.

HIGH-CYCLE LIGHTING

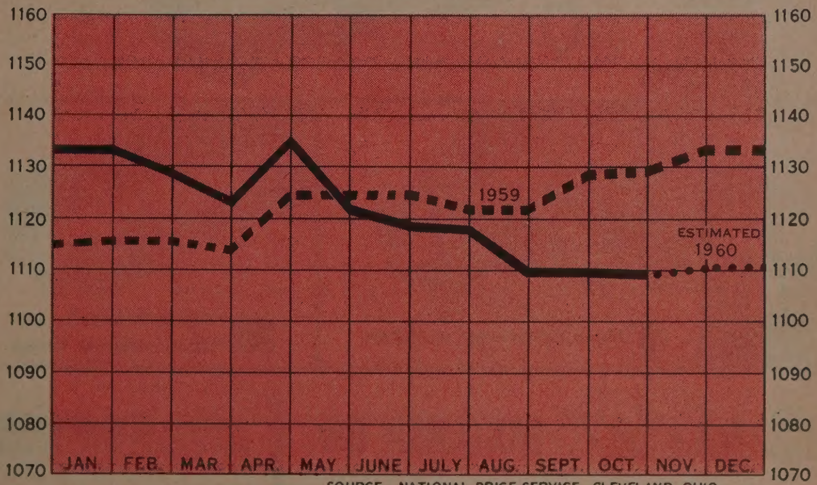
Another outstanding electrical installation employing a power system operating at higher than line frequency and voltage has been completed at the University of New Mexico gymnasium. The system was designed by Consulting Electrical Engineer Carl R. Albach of Santa Fe and installed by City Electric of Albuquerque. Custom designed, 10-lamp fluorescent fixtures mounted 42 ft above the floor are supplied at 600 volts and 400 cycles; a system permitting important reductions in fixture weight and a substantial increase in lumen efficiency. The installation is described in "High-Cycle Gymnasium Lighting" beginning on page 47.

NECA CONVENTION

Approximately 5,000 members and guests of the National Electrical Contractors Association descended on Las Vegas, Nevada, October 23 to 27, to set a new record for NECA convention attendance. Ample housing facilities were provided in the fabulous "strip" hotels and a brand new Convention Center easily held the large business sessions and the concurrent electrical trade show. Our cameras were busy and their output is presented in "Personalities," page 52. For the report of the convention proceedings, see "NECA Convenes in Las Vegas" beginning on page 135.

ELECTRICAL MATERIALS COST INDEX

BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT THE VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.



SOURCE - NATIONAL PRICE SERVICE, CLEVELAND, OHIO

NEW GAT®

B-Beam Clip

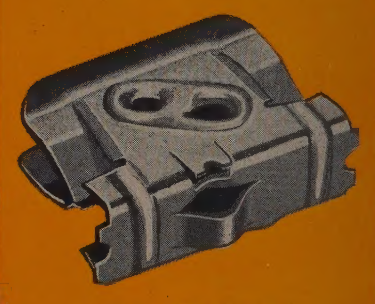
Recently announced by Erico Products, Inc. is the new "B" beam clip. Designed for and approved for telephone use to replace present universal Clamps and/or Support Brackets. This product has found additional markets in the electrical contracting field, sound and inter-communication industries.

For use with threaded or unthreaded Bridle Rings, Drive Rings and other low voltage Cable, Wire and Copper Thermostatic Tubing Supports.

Recommended Maximum Load Limits:

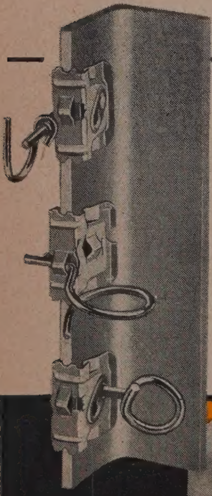
Horizontal Pull 30 lbs.	Vertical Pull 50 lbs.

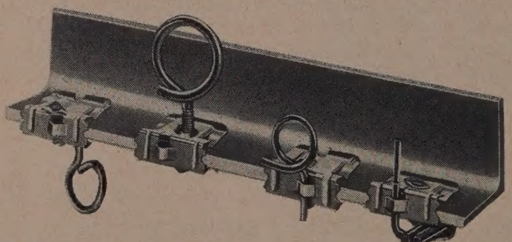
This clip will fit any flange from ⅛" thru ½" thickness regardless of flange taper.

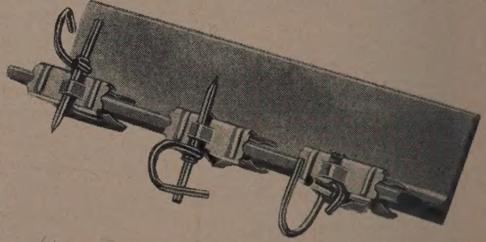


NOTE VERSATILITY OF B-BEAM CLIP

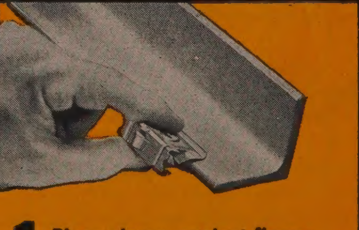
INSTALLATION APPLICATIONS



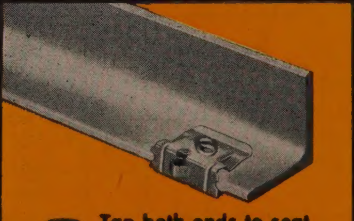




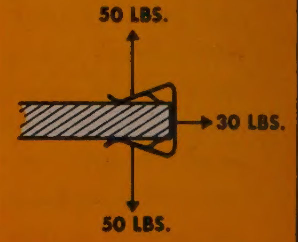
HOW TO INSTALL



1 Place clamp against flange



2 Tap both ends to seat clamp against flange



CADDY® FASTENER Div.

ERICO CADWELD PRODUCTS, INC.
2070 EAST 61st PLACE • CLEVELAND 3, OHIO

Washington Report

DECEMBER • 1960

The business curve will not change over the next few months, as a result of the Presidential election, in the opinion of most analysts. Over-all, business is expected to maintain its present level until some time early next spring, when it may turn up slightly. More government spending, a slight upturn in new construction spending, and sustained consumer spending during the months ahead are all expected to contribute to an eventual upturn. By this time inventory adjustments are expected to be completed, orders for steel should pick up, auto sales should increase, and demand for appliances should begin to build up again. Mainly, an early upturn in business would seem to hinge primarily on the vitality of business itself.

Personal income continued to rise in October, for the eighth month in a row. People had more money to spend, yet spent less, and put more into savings accounts. Income was at the annual rate (seasonally adjusted) of $409.6 billion, which compares with an annual rate of $403.5 billion for the first 10 months. Personal income in 1959 totaled $383.3 billion.

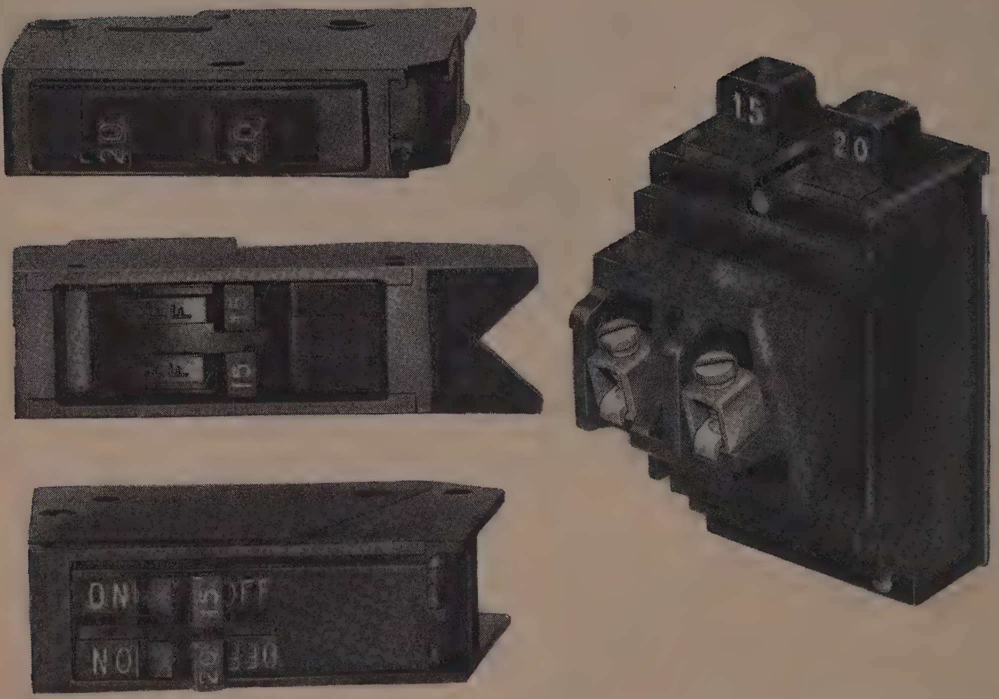
Construction spending in October totaled $5,092 million, or a seasonally adjusted annual rate of $55 billion. Private construction, at $3,478 million, was down slightly, but this decline was largely offset by a rise in public construction, at $1,614 million, due primarily to increased highway spending.

Housing starts for the first nine months of this year were 19% below the similar period last year, and 1960 starts are expected to wind up at about 1,250,000 units, compared with nearly 1.5 million in 1959. More than 16 million new houses and apartment units have been built since World War II, and Census Bureau reported rental vacancies in the third quarter at 7.6%. This leads many economists to believe that housing demand is slowing down. Outlays for modernization of old homes is on the rise. The Department of Commerce has predicted a modest 4% gain in home building for 1961, compared with this year, or about 1,300,000 private homes. This forecast is based on a strong recovery in the 2nd half of 1961.

Spending for private and public construction of all types in 1961 is forecast by Dept. of Commerce at $57.3 billion, a 4% gain from this year's expected total of $55.1 billion. Included in this forecast is a 7% increase in private outlays for industrial building, over this year's $2.9 billion total.

National statistics provide a measure of the economy as 1960 comes to a close, as follows:

- **Industrial output** in October was 107% of the 1957 average, same as for September.
- **Employment** in mid-October was 67.5 million, and **unemployment** was 3.6 million.
- **Cost-of-Living** (Consumers Price Index) in September was at an all-time high of 126.8% of the 1947-49 average.
- **Retail sales** in October were $18.5 billion, the second highest on record, and exceeded only by the $18.9 billion for April of this year.
- **Highway construction** averaged an annual rate of $6 billion in August, September and October, up sharply from 1959 rate. Contract awards for fourth quarter are expected to set a record.



Why buy "married couples" when

you can have the better half?

10th
Anniversary
Stab-lok
PROGRESS
WITHOUT
OBSOLESCENCE

Twin . . . tandem . . . duplex—"togetherness" by any name cuts your operating flexibility by 66⅔%. Only Federal Pacific gives you complete flexibility with one-third the cost in the first and still exclusive half-module, single pole 15 and 20 amp Stab-lok® circuit breakers. Mix them or match them in any combination—15-15, 15-20, 20-15, 20-20. You'll find two "better halves" cut inventory and space costs of "married couple" breakers by two-thirds. Another demonstration of the "leader look" from the Company that is celebrating ten consecutive years of continuing leadership in the industry. Ask for Bulletin FPB-1-1000. Federal Pacific Electric Co., Newark 1, N. J.

FEDERAL PACIFIC ELECTRIC COMPANY

FPE

growth through creative energy

SING OUT... SELL UP... SELL HOUSEPOWER

TRADE MARK

...Join the '61 HOUSEPOWER PROFIT PARADE

There's lots of money to be made in home wiring modernization by Electrical Contractors who will sell hard and sell up. These are the jobs Electrical Contractors get by *selling* instead of bidding. These are the jobs contractors *keep* by gaining the customer's confidence.

Exciting new merchandising program will help you lead the '61 HOUSEPOWER Profit Parade

Full details of the all-new line-up of sales aids, to help you put the earning power of HOUSEPOWER to work, will be presented at the National Wiring Sales Conference — Sherman Hotel, Chicago, Illinois — February 23-24, 1961.

Here's what you do to be among the first on the band wagon

1. Make plans now to join the leaders of the HOUSEPOWER Profit Parade at the Wiring Sales Conference.
2. Mail in this coupon immediately and be among the first to get full details of the best residential wiring business-building plan ever offered.

HOUSEPOWER
The National Wiring Bureau
155 East 44th St., New York 17, N.Y.

Absolutely! I want to receive announcement of the complete '61 HOUSEPOWER Parade of Profits program the minute they're ready. Please send me all details.

Name______________________________

Company____________________________

Address____________________________

City________________ Zone______ State__________

ECM-12

NATIONAL WIRING BUREAU
A sponsor of
HOUSEPOWER
TRADE MARK

ANOTHER ADVANCE FIRST!

"A"

SOUND RATED

NEW TWO-LAMP 40-WATT RAPID START FLUORESCENT LAMP BALLAST

SILENCE IS THE SOUND OF QUALITY

Again ADVANCE TRANSFORMER CO. brings the lighting industry another outstanding development in ballast design . . . an **"A"** sound-rated Two-lamp 40-watt Rapid Start Ballast. ADVANCE engineers developed this acoustically corrected ballast that absorbs the magnetic vibration of core and coil before it becomes sound.

By controlling vibration, the noise level of the new ADVANCE sound-conditioned ballast is lower than any Two-lamp 40-watt Rapid Start Ballast available today.

For silent fluorescent lighting in schools, libraries, hospitals and other critical areas where low noise levels are the primary consideration . . . demand ADVANCE **"A"** quiet-rated fluorescent lamp ballasts.

"The Heart of the Lighting Industry"®

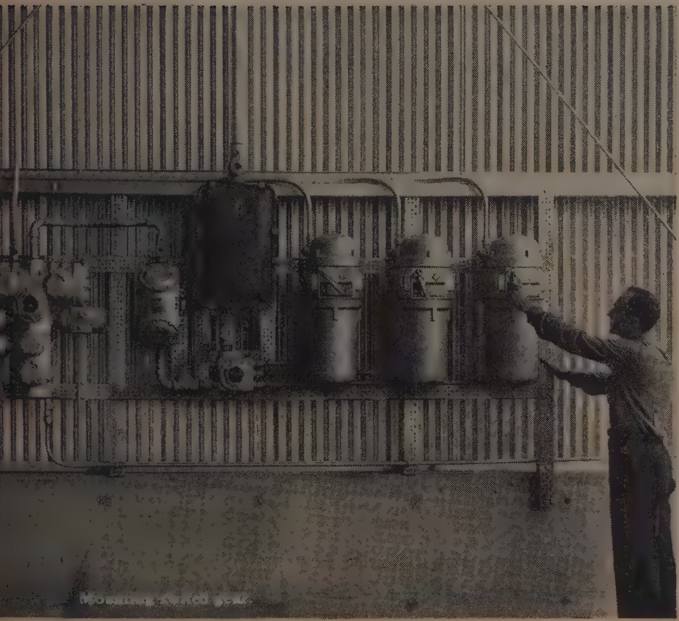
Mfg. in Canada by: Advance Transformer Co., Ltd. 5780 Pare St., Montreal, Quebec.

ADVANCE®
World's Largest Exclusive Manufacturer of Fluorescent Lamp Ballasts
TRANSFORMER CO.
2950 NO. WESTERN AVE. CHICAGO 18, ILL. U.S.A.

AIM BRAND
OKAYED by electrical
Free standing
mount for apparatus.

SLOTTED ANGLE

contractors on thousands of jobs



Mounting switch gear

Supporting runs of conduit

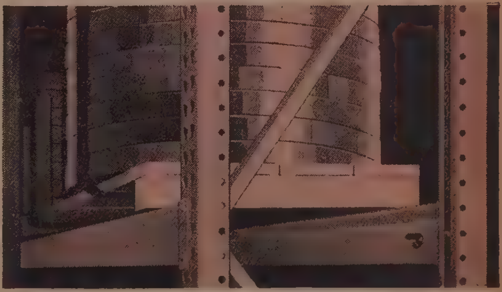
Electrical contractors are proving it every day! For framing, mounting and hanging electrical apparatus, AIM Brand Slotted Angle offers virtually unlimited economies, uses and design freedom.

Simple. Free your skilled men for other jobs—an apprentice or helper can master it in minutes. A hand wrench is all that's needed—no drilling, sawing, welding.

Fast. Once lengths are figured, they're quickly snipped to size with the AIM Brand Cutter. Marks every 3 inches speed measurements. Pieces simply bolt together. ⅜" holes accept all standard electrical fittings—no reaming or special adapters required.

Obsolete-proof. Say specs change—more runs of conduit are required. No loss—add on to the AIM Brand Slotted Angle and you're all set.

Giant savings. All savings totaled—initial material cost, handling, sizing, cutting and assembly time—job costs can be cut as much as 40% on every installation! AIM Brand is distributed nationally. For the name of your nearest distributor and free, illustrated booklet, contact your nearest ACME STEEL office or ACME STEEL COMPANY, Fabricated Materials Division, Dept. EAD-120, 135th Street & Perry Ave., Chicago 27, Ill.



Acme Steel AIM Brand Rack for heavy-duty storage offers greater stability, installation ease and tested load capacities.

Exclusive safety load locking device* and two button head studs provide three point bearing per beam connection for positive protection against accidental disengagement of beams. Write for details.

*Patent applied for

ACME STEEL

IDEA LEADER IN
FRAMING

AIM BRAND

NOW . . . a simple, effective, low cost method of preventing electrical failure due to moist and corrosive atmospheres

Failure of physical or electrical characteristics of electrical and electronic equipment is often due to moisture and corrosion. Without effective moisture protection, deterioration sets in, leading to costly downtime, expensive repairs and high replacement incidence.

Dual-action CRC 2-26 eliminates or greatly reduces these failures. It displaces moisture on surfaces—gets into grain boundaries, cracks and pores—and leaves a thin, continuous molecular film that both stops and prevents corrosive action on metals, plastics, rubber, plated and painted surfaces.

Dimensional characteristics, contact resistance and other electrical constants remain unchanged. CRC 2-26 does not become dry, brittle or hard. Because it is non-irritating, non-toxic and has a high flash point, CRC 2-26 is easily applied without special precautions. It is used to maintain equipment year after year that formerly burned out or needed extensive servicing every few months.

Write for complete information to Corrosion Reaction Consultants, 116-A Chestnut St., Philadelphia 6, Pa., or telephone WAlnut 5-0200.

A SUBSIDIARY OF THE CHAS. J. WEBB SONS CO., INC.

Place your order now with your Electrical Distributor

CRC® FORMULA 2·26

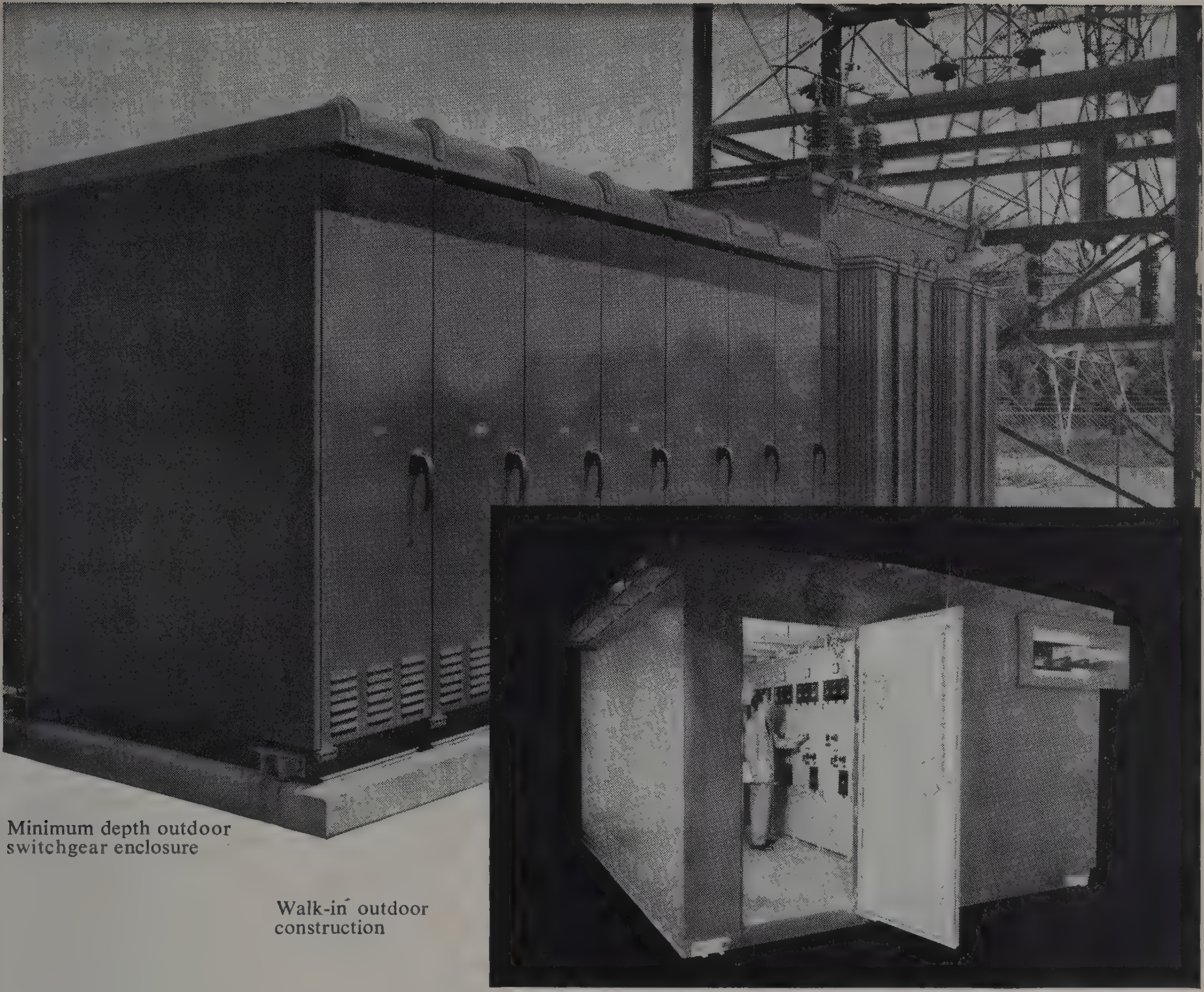
FOR THE ELECTRICAL INDUSTRY

TYPICAL EQUIPMENT MAINTAINED BY CRC 2-26

- Switchgear
- Circuit breakers
- Contactors
- Fuses
- Relays
- Solenoids
- Rectifiers
- Transformers
- Instruments
- Motors
- Generators
- Cables
- Insulation
- Coils
- Timers
- Conduits
- Fixtures
- Panelboards
- Blowers
- Signals
- Controls
- Recorders
- Shielding
- Counters
- Housings
- Chassis
- Oscillators
- Rheostats
- Sub-assemblies
- Synchronizers
- Transmitters
- Receivers
- Ignition systems
- Microphones
- Tubes
- Welders

Supplied in 16 oz. aerosol cans, 1 and 5 gal. cans, 55 gal. drums

CRC® 2·26 LOW COST PROGRAMS FOR PREVENTIVE MAINTENANCE



Minimum depth outdoor switchgear enclosure

Walk-in outdoor construction

All-new switchgear makes I-T-E primary unit substation better buy than ever

I-T-E custom designs your primary substation just for you—to meet your exact power, space and future expansion requirements—yet charges you nothing extra. This is just one of the ways that I-T-E gives you a better buy.

And now! I-T-E primary unit substations come with completely new HK switchgear as standard equipment. You get all the advantages of today's most advanced switchgear in outdoor equipment: new compactness, stored energy closing, new ease of access, and new safety for personnel. It's available in minimum depth outdoor enclosures for areas where space is limited, or outdoor walk-in construction for easy maintenance in bad weather. All doors and joints are completely gasketed. All parts are treated for rust resistance and painted prior to assembly.

I-T-E primary unit substations are available in all standard kva ratings and secondary voltages to 13.8 kv. Write for complete information. I-T-E Circuit Breaker Company, Dept. SW, 1900 Hamilton St., Phila. 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY

Announcing a new dimension in lighting

THE FAIRVIEW IV

Day-Brite's newest design achievement delivers today's higher recommended footcandle levels while retaining the trim, sleek look so sought-after in modern architectural planning. Its clean, crisp styling fits neatly into school, store, office or institutional applications.

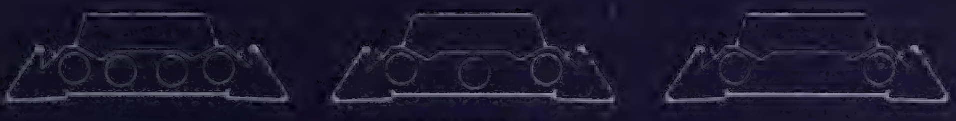
A companion fixture to the popular FAIRVIEW II, the FAIRVIEW IV is especially designed for two, three, or four lamps parallel. 8-foot units also available in tandem Rapid-Start or 8-foot Slimline lamps. Can be suspended or surface mounted.

X-5 prismatic CLEARTEX® enclosure controls brightness . . . translucent sides wipe out harsh ceiling contrasts. Both enclosure and channel are of one-piece construction for simplified installation and servicing.

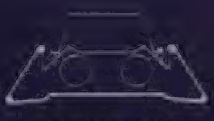
For more information on the new FAIRVIEW IV, contact your Day-Brite representative listed in the Yellow Pages or write: *Day-Brite Lighting, Inc., 6260 N. Broadway, St. Louis 15, Mo. and Santa Clara, Calif. In Canada: Amalgamated Electric Corp., Ltd., Toronto 6, Ont.*

DAY-BRITE

NATION'S LARGEST MANUFACTURER OF COMMERCIAL AND INDUSTRIAL LIGHTING EQUIPMENT



FAIRVIEW IV
2, 3, or 4 lamps parallel. 14" wide, 4⅜" deep

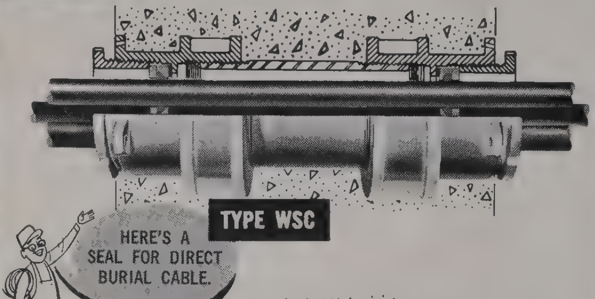


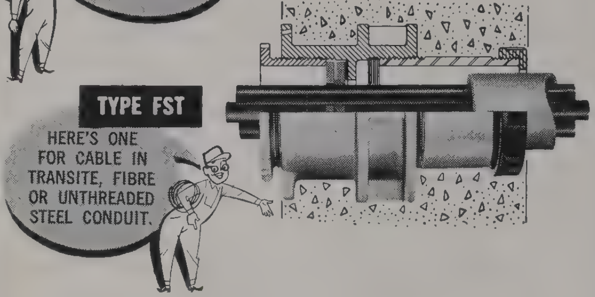
FAIRVIEW II
10" wide, 4⅜" deep

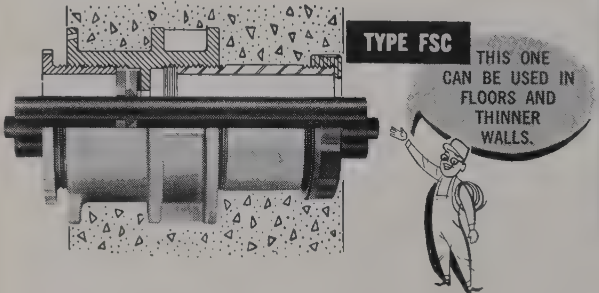
NEW! a complete line of O.Z. WATERTIGHT ENTRANCE FITTINGS

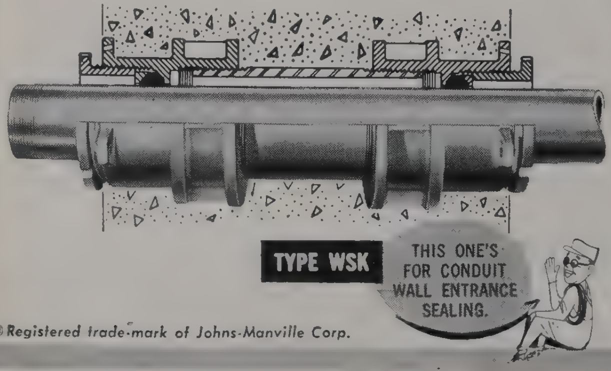
for Conduit or Cable

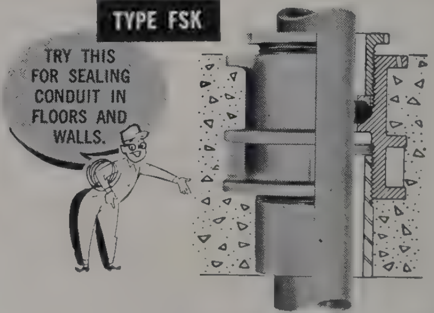
End leakage problems once and for all! O.Z.'s new wall and floor entrance fittings for installation in concrete provide a positively watertight seal around conduit or cable at any pass-through point! Use them with threaded or unthreaded steel conduit, fibre or Transite® conduit, or exposed cables of varying number and sizes. Gland-type sealing assemblies, with pressure bushings, may be tightened at any time. Fittings accommodate conduit ranging from ¾" to 6". Standard types, sizes available from stock. Specials made to order.


TYPE WSC


TYPE FST
HERE'S ONE FOR CABLE IN TRANSITE, FIBRE OR UNTHREADED STEEL CONDUIT.


TYPE FSC


TYPE WSK


TYPE FSK

®Registered trade-mark of Johns-Manville Corp.

For more information on fittings and other O.Z. products, call your local distributor, or write to the company.

Copyright 1960 O.Z. Electrical Manufacturing Co., Inc.

O.Z. ELECTRICAL MANUFACTURING CO., INC.
262 BOND STREET • BROOKLYN 17, N. Y.

- CAST IRON BOXES
- CABLE TERMINATORS
- POWER CONNECTORS
- SOLDERLESS CONNECTORS
- GROUNDING DEVICES
- CONDUIT FITTINGS
- INTERLOCKED ARMOR CABLE FITTINGS

Sales Office and Warehouse: 406 So. Cicero Avenue, Chicago 44, Ill. • ESterbrook 9-0326
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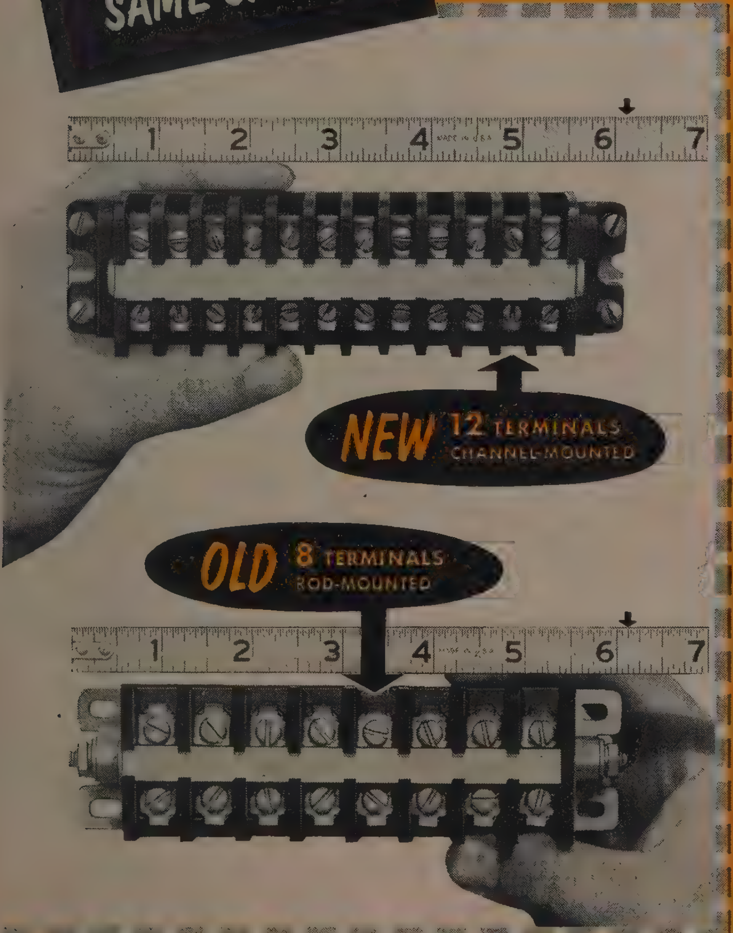
50% MORE TERMINALS IN THE SAME SPACE!

SQUARE D's *NEW* TERMINAL BLOCKS

MORE FLEXIBILITY, TOO!



NOTICE *(above)* **how little space is required to remove or add a Square D channel-mounted terminal block to the completely assembled unit. Especially important for a quick change when an additional terminal must be inserted into grouping.**

LOOK *(at right)*... **all sizes can be mounted on same channel...25 ampere pressure wire connectors, 25 to 50 ampere box lugs ...all can be interlocked together. Terminals in kit form to "do-it-yourself" or factory-assembled to standard specifications.**

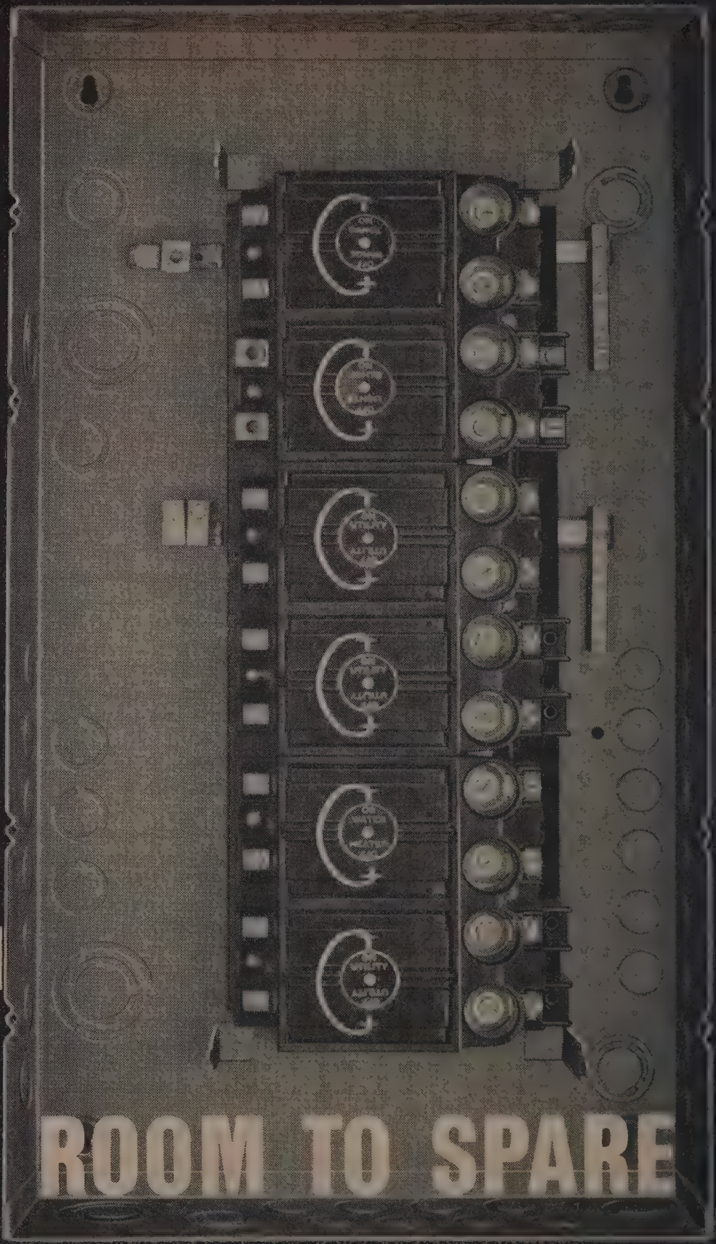
***NEW*...fusible terminal block** *(below)* **for protection of solenoids and other single or three-phase loads. Mounts on same channel as regular terminal blocks. Available factory-assembled or in kit form for customer assembly.**

ASK YOUR SQUARE D FIELD ENGINEER
or write for Bulletin which covers details on Channel-Mounted Terminal Blocks. Address Square D Company, 4041 North Richards Street, Milwaukee 12, Wisconsin.

SQUARE D COMPANY

wherever electricity is distributed and controlled

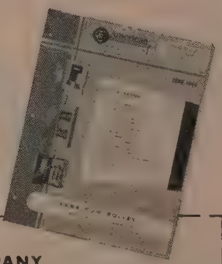
...when it comes to wiring CLARK-AMERICAN ...there's ROOM TO SPARE



VITAL ROOM FOR WIRING is yours with Clark-American entrance equipment. The ability to *leave room* in compact equipment is a Clark trademark. It stems from years of industrial experience.

Your own comparison will prove that Clark-American equipment, with *ample wiring space,* makes for faster, more reliable installations at lower cost. And, you will find the right equipment for any job at one source—your American Switch distributor.

The complete line (capacities range from 60 to 200 amperes) is presented in the new Clark-American PRODUCT GUIDE. Free on request, this booklet contains helpful installation and application data. See your American Switch distributor, or mail the coupon.



FREE PRODUCT GUIDE lists complete Clark-American line. Helpful installation and application data. Send for your free copy today.

THE CLARK CONTROLLER COMPANY
1146 East 152nd Street
Cleveland 10, Ohio

Please send me the Clark-American PRODUCT GUIDE.

Name__________Title__________

Company__________

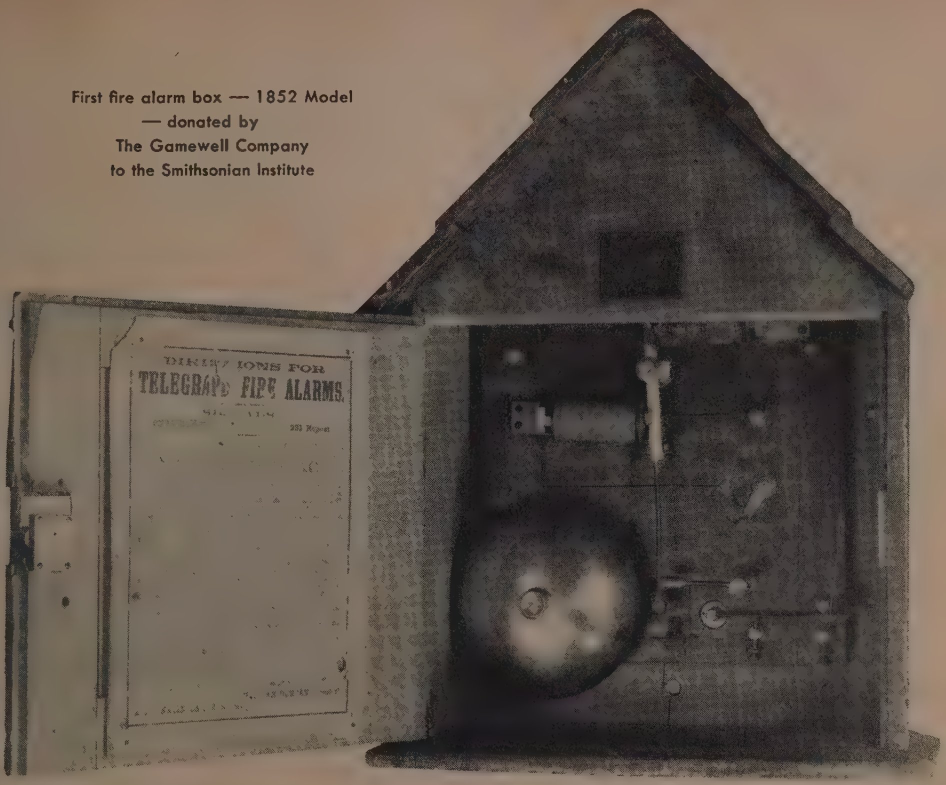
Address__________

City__________Zone_____State__________

American
ELECTRIC SWITCH DIVISION

The
CLARK CONTROLLER
Company
"Everything under Control"
1146 East 152nd Street, Cleveland 10, Ohio

First fire alarm box — 1852 Model
— donated by
The Gamewell Company
to the Smithsonian Institute

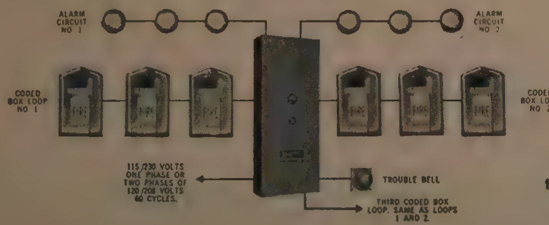


A century of positive protection...

More than a hundred years ago, the wooden, hand-cranked Gamewell Fire Alarm box shown above was the most dependable fire alarm device of its day. And, during the years since then, Gamewell has consistently pioneered in the manufacture of emergency signaling systems . . . with thousands of municipal and industrial systems in daily service.

That's the performance record you can depend on when you specify today's modern, highly automated Gamewell industrial FLEXALARM system like that shown below. Such systems are pre-engineered to meet the precise needs of any plant. FLEXALARM systems are available with unlimited variations. They provide automatic fire detection devices, sensing fire in its incipient stages . . . with optional direct and automatic connections to municipal and other central fire stations. Connected to sprinkler systems, FLEXALARM systems automatically transmit an alarm on water-flow preventing loss from fire and water damage. These systems provide *complete* coverage.

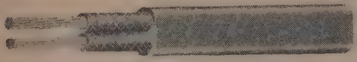
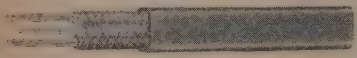
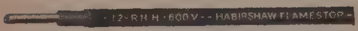
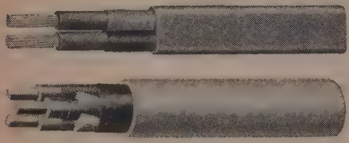
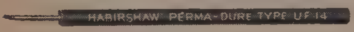
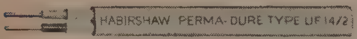
Gamewell is happy to assist the consulting engineer and electrical contractor with emergency signaling systems for any property. For maximum protection at minimum cost, specify Gamewell on your next project. For details write THE GAMEWELL COMPANY, 1313 Chestnut Street, Newton Upper Falls 64, Massachusetts. *A Subsidiary of E. W. Bliss Co.*


ALARM CIRCUIT NO 1
ALARM CIRCUIT NO 2
CODED BOX LOOP NO 1
CODED BOX LOOP NO 2
FIRE
115/230 VOLTS ONE PHASE OR TWO PHASES OF 120/208 VOLTS 60 CYCLES.
TROUBLE BELL
THIRD CODED BOX LOOP. SAME AS LOOPS 1 AND 2.

One of today's typical FLEXALARM Coded Systems.

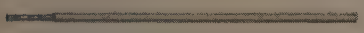
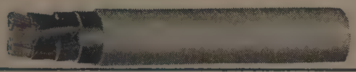
BLISS
Gamewell®
FIRST...WHEN SECONDS COUNT

Index of Phelps Dodge

Wires and Cables	*Type Letter*	*Trade Name or Designation*	*Maximum Operating Temperature*	*USE*
	ACV	Armo-Lok	85 C (185 F)	Dry Locations
	None	Armo-Lok	85 C (185 F) High Voltage	General Purpose: Consult manufacturer for specific applications
	**W**	Portable Power Cable	75 C (167 F)	Mining Machines, Dredges, Shovels, and similar portable applications Pennsylvania Dept. of Mines Flame Resistance Approval P-114. U. S. Bureau of Mines Listing P-114-BM.
	**G**		Low Voltage	
	SHD		85 C (185 F) High Voltage	
	RHW	Flamestop Heat and Moisture Resistant	75 C (167 F)	Dry and Wet Locations
	**RHH**	Flamestop Heat-Resistant	90 C (194 F)	Dry Locations
	**RHL**	Heat Resistant Rubber Lead	75 C (167 F)	Wet Locations and other Special Conditions
	NM	PD-X Nonmetallic-Sheathed Cable	60 C (140 F)	For Wiring Houses, Rural Buildings, Small Stores, and Shops.
	**UF**	Perma-Dure Nonmetallic-Sheathed Cable	60 C (140 F)	UF: Underground Feeder and Branch Circuit Cable for Direct Burial.
	**UF-NMC**			NMC: For Interior Wiring in Moist or Corrosive Locations.
	THW	Habirdure Thermoplastic insulated	75 C (167 F)	Dry and Wet Locations
	TW		60 C (140 F)	Dry and Wet Locations
	TF		60 C (140 F)	Fixture Wire
	None	Petro-Dure Thermoplastic Insulated Nylon Jacketed	60 C (140 F)	Moist locations and where exposed to mineral oil, liquid gasoline and gasoline vapor.
	None	Habirdure Machine Tool, Control, and Switchboard Wire	90 C (194 F) in air 80 C (176 F) in oil	Machine Tool, Control and Switchboard Wiring

PHELPS DODGE COPPER PRODUCTS CORPORATION

Wires and Cables

Wires and Cables	*Type Letter*	*Trade Name or Designation*	*Maximum Operating Temperature*	*USE*
	TW	Habirdure (9T)	60 C as TW 90 C as Appliance Wiring	NEC Type TW Bldg. Wire—60°C Appliance Wiring—90°C in air or 60°C in water or oil
	**None**	Habirdure Appliance Wire	105 C (221 F) IN AIR 80 C (176 F) IN OIL	Appliance Wiring
	SE	Service Entrance Type SE — Style U Unarmored	75 C (167 F)	Service Entrance or Combination Service Drop & Service Entrance
	SD	Service Drop Type SD	60 C (140 F)	Service Drop
 	USE	Service Entrance Type USE	75 C (167 F)	Underground Service Entrance, Direct Burial.
	V	Varnished Cloth Braided	85 C (185 F)	Dry locations only. Smaller than No. 6 by special permission.
	**VL**	Varnished Cloth Lead	85 C (185 F)	Wet or Dry locations. Smaller than No. 6 by special permission.
   	None	Habirduct Habirprene	75 C (167 F) Low Voltage	General Purpose for Direct Burial, Aerial, Conduit and Underground Duct Installations.
		Habirite Habirprene	85 C (185 F) High Voltage	
	S or SO	Hard Service Cord	60 C (140 F)	Pendant or portable extra hard usage in damp locations; SO for oil resistance
	SJ or SJO	Junior Hard Service Cord	60 C (140 F)	Pendant or portable hard usage in damp locations; SJO for oil resistance
	SP	All Rubber Parallel Cord	60 C (140 F)	For use in pendant or portable applications in damp locations not subject to hard usage

NEW GENERAL ELECTRIC SIZE 00 STARTER SAVES YOU MONEY, HAS PROVED 100-LINE BENEFITS

For small fans, blowers, pumps, compressors, other low hp applications

Designed to handle low-horsepower applications, General Electric's new 100-Line Size 00 Magnetic Starter costs you 18 percent less than the Size 0 starter in its most popular forms.

Rated at 1 hp, 230 volts single-phase, 2 hp, 550 volts three-phase maximum, the Size 00 starter can be used for remote as well as automatic operation by installing a push button or selector switch in the cover.

The new Size 00 starter also gives you the same proved-in-operation benefits—easier installation, quicker inspection, and maintenance without tools—common to all starters in General Electric's 100-Line family. For instance, it features straight-through wiring, snap-slide construction, and pressure type terminals.

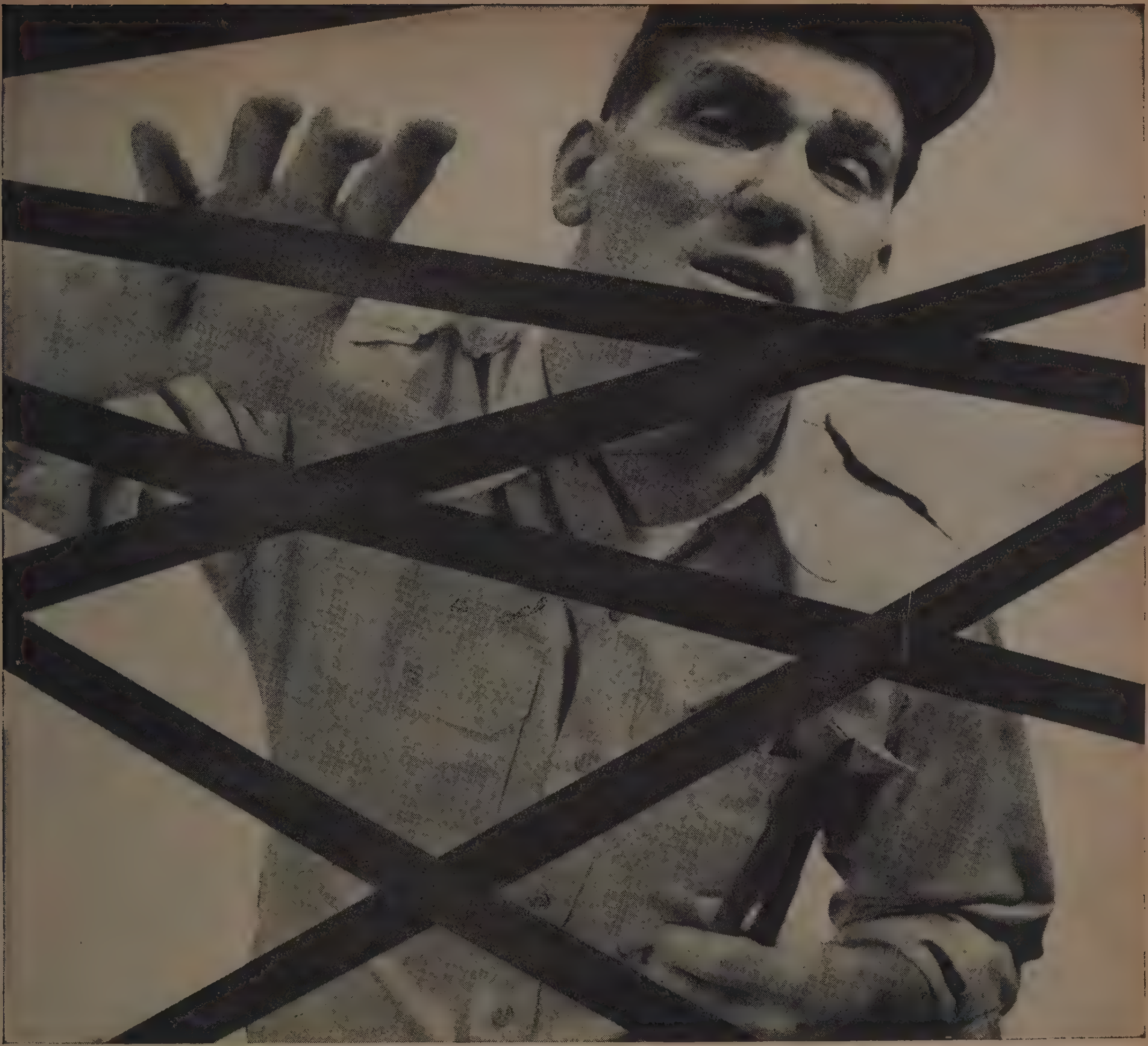
For more information on this new low-cost starter and the Measurable Advantages it offers you, ask your nearby G-E Distributor for Publication GEA-7304 or write to Section 812-04, General Electric Co., Schenectady 5, N. Y.

COMPARATIVE HORSEPOWER RATINGS, SIZE 00 AND SIZE 0

Starter Size	Single-Phase			2- and 3-Phase		
	115V	230V	440/600V	110V	208/220V	440/550V
00	1/3	1	—	3/4	1 1/2	2
0	1	2	3	2	3	5

Progress Is Our Most Important Product

GENERAL ELECTRIC



Don't Tie Yourself Up In Excess Tape

Save Money with Dutch Brand's new Plastic Electrical Tape in 44-ft. Rolls

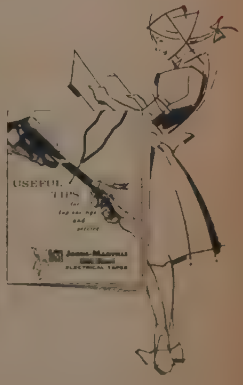
Dutch Brand's new 44-ft. roll of Plastic Electrical Tape costs no more per foot than a 66-ft. roll. To you, this means less funds sunk in inventory. It also means you are *not* tied up in excess tape footage that invites waste and pilfering.

Dutch Brand Plastic Electrical Tape is the easy, *better* way to do scores of electrical maintenance jobs. It's thin, strong, flexible . . . provides a dielectric strength of 9,000 volts. Also provides unusual resistance to acids, alkalies, oils, solvents, fungus, bacteria, and gases. Made to highest industry standards. Available in 20'—44'—66' rolls. Order Dutch Brand Plastic Electrical Tape from your supplier today.

WRITE FOR NEW ELECTRICAL BOOKLET!

"Useful Tips for Top Savings and Service." It contains dozens of cost-saving ideas.

Johns-Manville Dutch Brand Division, 7800 South Woodlawn Avenue
Chicago 19, Illinois



JOHNS-MANVILLE
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PRODUCTS

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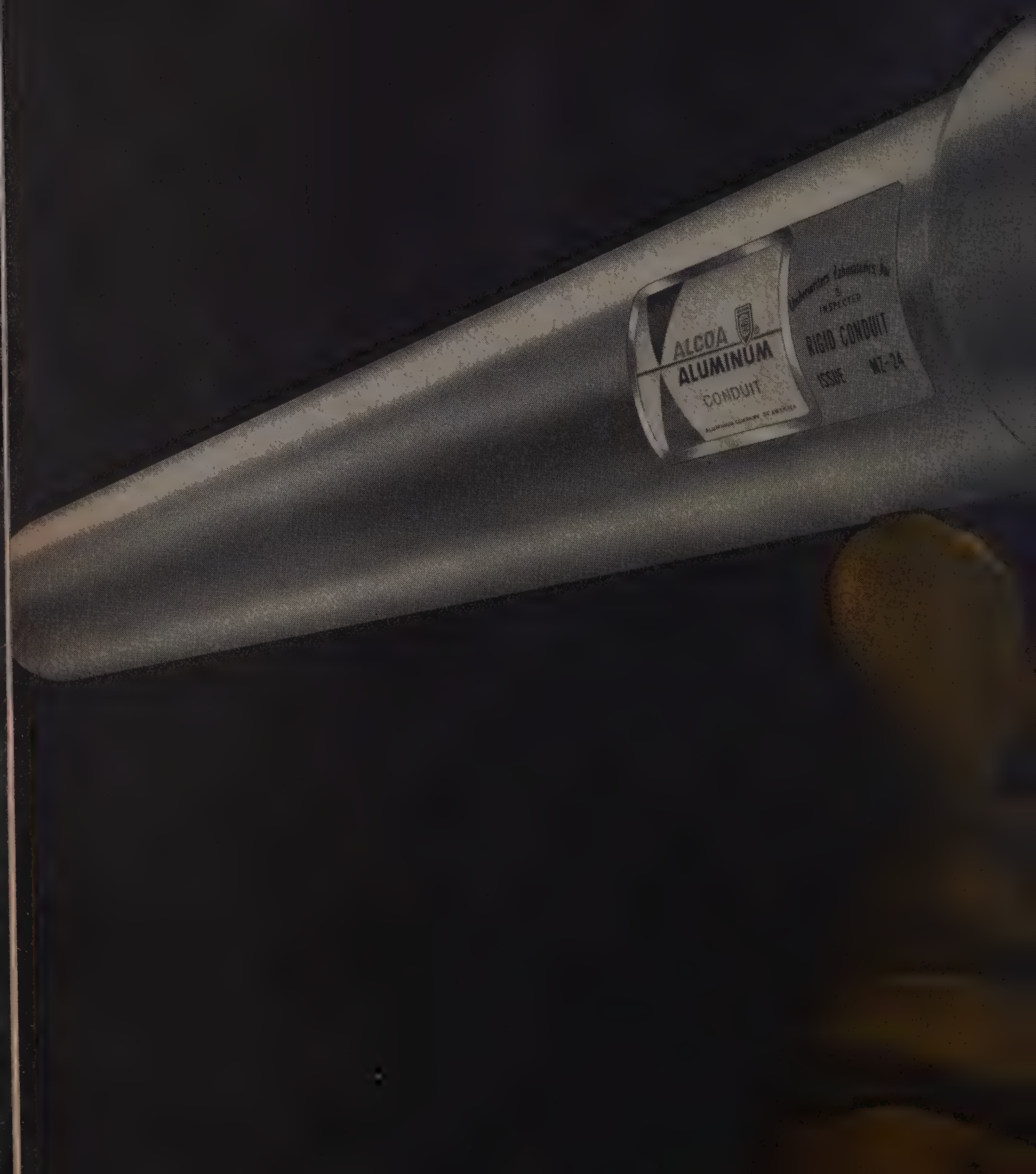

ALCOA
ALUMINUM
CONDUIT
ALUMINUM COMPANY OF AMERICA
Underwriters Laboratories Inc
INSPECTED
RIGID CONDUIT
ISSUE MZ-24

Light weight!

One reason why Alcoa aluminum electrical rigid conduit costs less to install

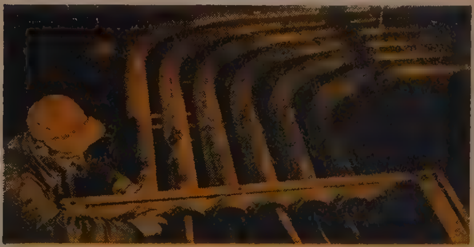
Heft a 10-foot length of 4-inch aluminum conduit. It weighs just 34 pounds. Compare this with 98 pounds for a similar section of steel conduit.

You benefit from this weight advantage in every phase of handling—lifting, loading, carrying, erecting. Result? Jobs go up faster.

You'll also find that aluminum conduit is easier to cut, bend and thread than conventional conduit. A hacksaw is adequate for cutting most sizes; bending usually is a one-shot task; and regular dies and cutting oils give you clean, sharp threads in a hurry.

Aluminum conduit is nonsparking, nonmagnetic, corrosion-resistant, and nontoxic. It looks good when you put it up and stays that way for years and years.

Get all the facts and figures in time for your next job. Contact your electrical distributor or one of our representatives. Or drop us a line for free literature. Write to Rome Cable Division of Alcoa, Dept. 7-120, Rome, New York.



OTHER REASONS WHY it costs less to install Alcoa conduit: you can cut it easily with a hacksaw, bend with an EMT bender, and thread quickly with a regular sharp die.

ROME CABLE
DIVISION OF **ALCOA**

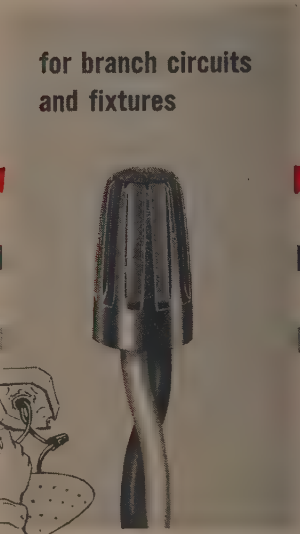
Just a twist of the wrist makes

IDEAL

for heavy gauge branch circuits

Wing-Nut

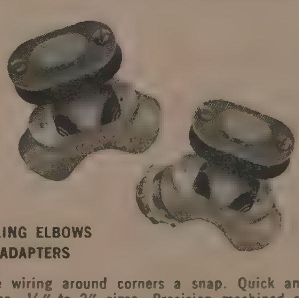
The newest! And just look at that grip! Say good-bye to sore thumbs and wrenches. Wing-Nut's built-in grip makes it a snap to splice even the hardest, heaviest branch circuit wires. New internal tension-spring coils hold splice with powerful "Python Grip". And you can see your splice is right, through the tough, semi-transparent Nylon shell. After splicing, you can clip off the wings for compact spaces. U. L. approved for aluminum-to-aluminum splices.



for branch circuits and fixtures

Wire-Nut®

The original! Every day, every year, more splices are made with Wire-Nuts than with any other connector. Economical, handy, easy to use. Wire-Nuts screw on easily, yet exert a tremendous grip that actually **crushes** wires together. All one piece, with rugged bakelite shell, it can't shake off. Five sizes for fixtures and branch circuits.



PULLING ELBOWS and ADAPTERS

Make wiring around corners a snap. Quick and easy to use. ½" to 2" sizes. Precision machined of malleable iron for smooth pulling, perfect 90° fit. Cadmium plated, chromate treated. Sold assembled complete with domed covers, big screws, full neoprene gaskets. Sizes marked on covers and elbows.

"Three-Sixty" FIXTURE HANGERS

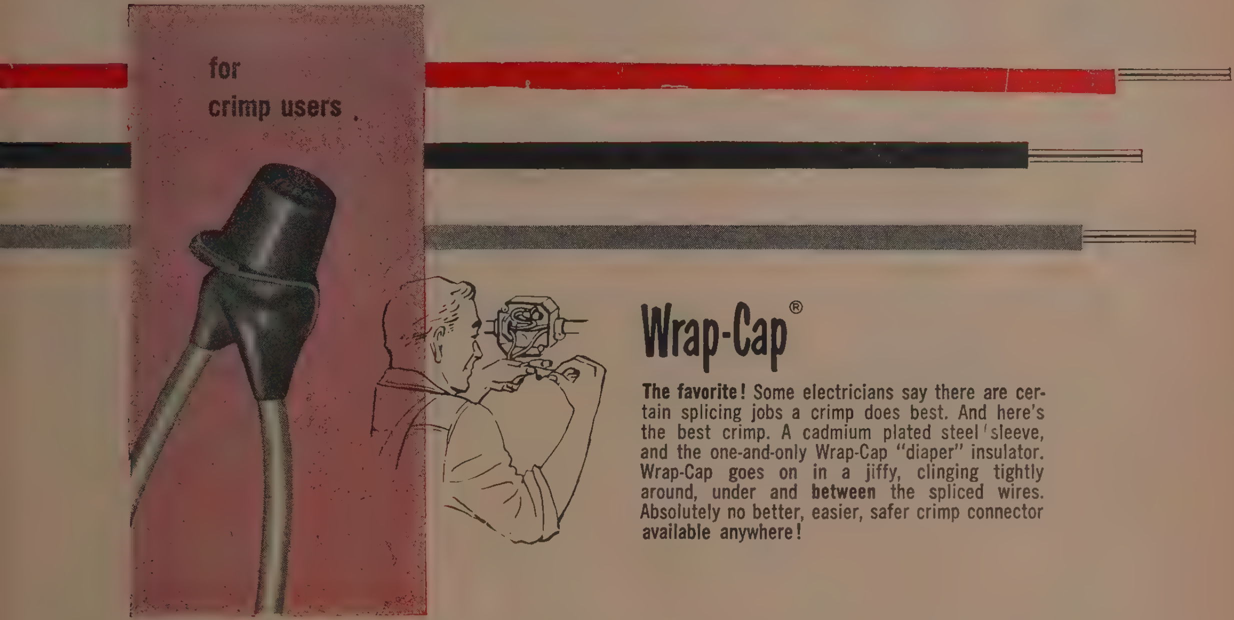
The only hanger with choice of 10 different receptacles. Full 360° adjustment after mounting—exclusive friction ring suspension rotates all the way around. Aligns fixtures instantly, with just a twist of the wrist. Permits hanging two or four chains, or S-hooks from small compact arms. Bright cadmium plated.

your wiring jobs easier . . .

Sleight-of-hand? No, not really. Yet thousands of contractors and electricians agree there almost *is* something magic about the way the IDEAL brand on a product makes any wiring job easier.

Take wire connectors, for instance. Some of you may remember about 30 years ago when Ideal introduced the *first* screw-on connector. Today's Wire-Nuts are even better, and are standard items in just about every electrician's pocket. And now the Ideal connector line includes the exciting new Wing-Nut, and the ever-popular Crimp and Wrap-Cap.

At every step along your job, Ideal offers a helping hand. There are super-flexible fish tapes with built-in pulling reels, precision wire strippers, cable rippers, pliers, wire lubricants, voltage testers . . . There's more; but we suggest you use the coupon below to get your own private copy of the new IDEAL CONTRACTOR-ELECTRICIAN CATALOG. Then you'll see for yourself the full meaning of the little red hand down in the coupon.



Wrap-Cap®

The favorite! Some electricians say there are certain splicing jobs a crimp does best. And here's the best crimp. A cadmium plated steel sleeve, and the one-and-only Wrap-Cap "diaper" insulator. Wrap-Cap goes on in a jiffy, clinging tightly around, under and **between** the spliced wires. Absolutely no better, easier, safer crimp connector available anywhere!

IDEAL INDUSTRIES, Inc. • Sycamore, Illinois • In Canada: Irving Smith, Ltd., Montreal

SOLD THROUGH AMERICA'S LEADING DISTRIBUTORS

NEW VAP-OIL-TITE CONNECTORS

The only completely re-usable connector for use with liquid-tight, flexible metallic conduit. Provides absolute water and oil-tight seal — vapor, dust, grit cannot get through. Double positive seal — exterior and interior neoprene O-rings, meet JIC standards. Assembles quickly, easily. Absolutely won't pull apart. All parts can be reused over and over again. Standard design sizes ⅜″ to 1½″, 2½″, 3″, 4″.

IDEAL INDUSTRIES, Inc.
1041-L Park Avenue, Sycamore, Illinois

IDEAL

THE HELPING HAND
ON EVERY
WIRING JOB

Yes, I would like a copy of the new
IDEAL CONTRACTOR-ELECTRICIAN CATALOG.

Name______________________________

Title______________________________

Company______________________________

Address______________________________

City__________________Zone______State__________

©I. I. Inc., 1960

how good should power cable be

...*for long term stability?*

It isn't enough to meet or barely surpass specifications—not when it is possible to build maximum performance into power cable—as Circle does. Take, for example, the IPCEA-NEMA 60 cycle water absorption test.

Circlesheath® Type RR Power Cable Performance

In the IPCEA-NEMA "Accelerated Water Absorption Tests," Section 6.9, a sample of power cable is immersed in 50°C water for a period of 14 days during and after which time specific inductive capacity and stability factor are measured.

Not only does Circle butyl-insulated power cable far surpass all minimum specifications after 14 days immersion—*but continues to do so after one year and eight months of continuous immersion. And the test is still going on!*

Date of original immersion: September 1958 Date of last test: April 1960

CABLE DESCRIPTION: 15KV, UNGROUNDED, SHIELDED	CIRCLESHEATH® CHANGE SIC	PERFORMANCE STABILITY FACTOR
700,000CM	4.3%	.6%
300,000CM	3.9%	.5%
300,000CM	3.6%	.4%

IPCEA-NEMA Requirements: Change SIC 1 to 14 days: 5% max.— stability factor after 14 days: 1% max.

The manufacture of high-reliability power cable is no accident. It requires expert knowledge of compounding techniques, absolute quality control—and production men who not only care enough . . . but *know enough* to produce the very best.

Circle CIRCLOC* Interlocked Armored Cable combines flexibility with mechanical protection in one lightweight, economical construction. It trains easily over obstructions; is ideal for future plant expansion. Available in galvanized steel, bronze or aluminum armor—from 600 to 15,000 volts.

CIRCLE **WIRE & CABLE**
a subsidiary of
Cerro de Pasco Corporation

RUBBER COVERED WIRE & CABLE • VARNISHED CAMBRIC CABLE •
PLASTIC INSULATED CABLE • NEOPRENE SHEATHED CABLE • CIRTUBE* EMT

1′ x 4′ PLEXIGLAS lenses mounted in continuous line, Ronkonkoma Primary School, Long Island. Architect for both schools shown: Frederick E. Allardt, Jr.

2′ x 2′ PLEXIGLAS lenses mounted in pairs, Southampton High School, Long Island.

PLEXIGLAS

for lighting that stands out and stands up

When lighting equipment includes control lenses molded of PLEXIGLAS® acrylic plastic, the result is illumination of the highest quality—because PLEXIGLAS is:

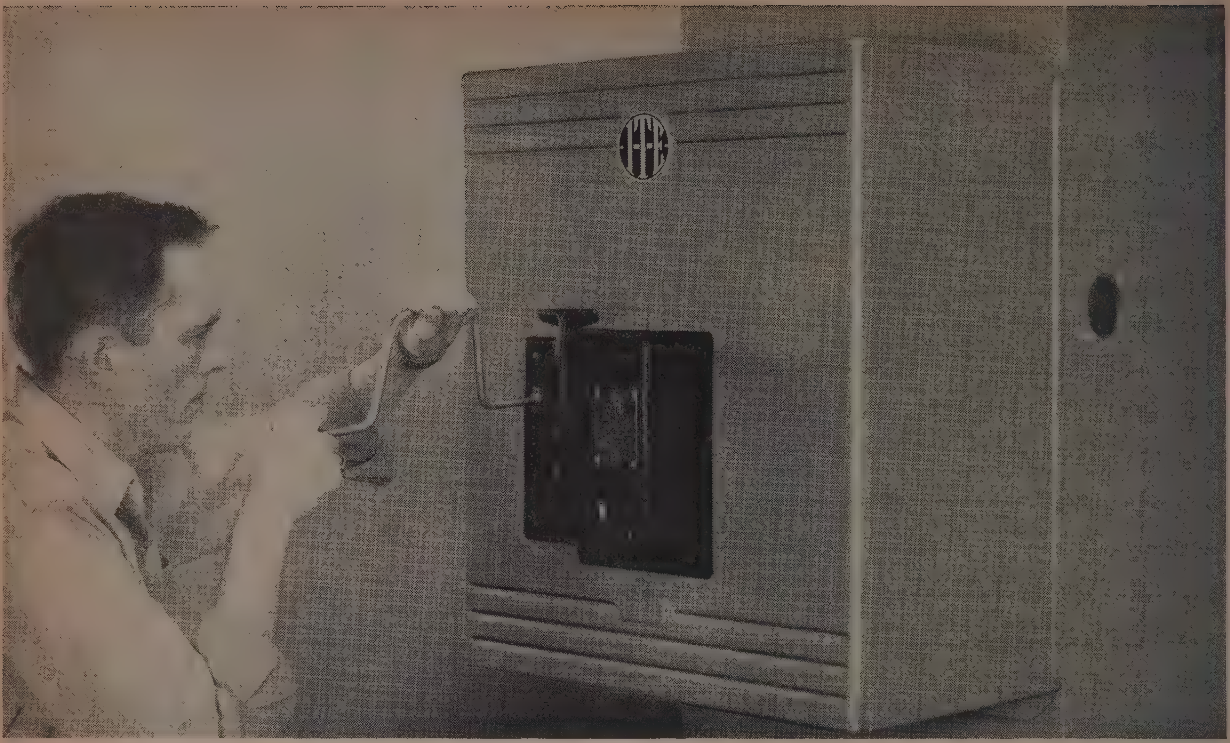
- molded accurately to the lens pattern, to produce a precisely designed optical element which achieves functional quality illumination. With lenses of the types shown in the installations above, light rays are "bent", providing complete freedom from glare at any normal viewing angle.
- impervious to discoloration from years of exposure to fluorescent light.
- strong and rigid yet light in weight, resulting in safety overhead and ease of maintenance.
- crystal clear, assuring full utilization of light with complete visual comfort.

Full details on PLEXIGLAS as a lighting material are contained in our new technical bulletin, "PLEXIGLAS for Lighting". We will be glad to send you a copy.

Chemicals for Industry

ROHM & HAAS
COMPANY
WASHINGTON SQUARE, PHILADELPHIA 5, PA.

In Canada: *Rohm & Haas Company of Canada, Ltd.,*
West Hill, Ontario



Urelite® gives you double safety

Exclusive with I-T-E

Independent drawout design
Visible separable contacts

In an individually enclosed large air circuit breaker, you couldn't ask for more safety than the I-T-E Urelite gives you. To disconnect it, just insert the crank at the front and turn. Cover need never be removed. A look through the side window positively shows you the position of the separable contacts. Also, with the circuit breaker open, it can be padlocked safely in either connected or disconnected position.

The whole truth is that Urelite breakers are unmatched for exclusive safety provisions, and for low-cost installation, easy access, longer contact life, and adjustable overload devices for higher loads. They handle circuits up to 600 volts, 15 to 4000 amp continuous and 150,000 amp interrupting. Write for new bulletin 4261-2B. I-T-E Circuit Breaker Company, Dept. LA, 1900 Hamilton St., Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY

HANDIER THAN AN EXTRA HAND -- that's Slipknot's exclusive, permanent plastic cutter-and-case — yours at no extra cost! This new tool saves time, tape and temper — and keeps your favorite tape clean and ready, whatever the job!

NOW... No. 7 SLIPKNOT
PLASTIC ELECTRICAL TAPE ...

ALWAYS CLEAN

in the NEW FLiP-n-CuT pat. pending
INSTANT TAPE DISPENSER
FREE... WITH EACH 66' ROLL

PLYMOUTH RUBBER COMPANY, INC.
QUALITY SINCE 1896 CANTON, MASSACHUSETTS

TAPES BY
SOLD ONLY THRU RECOGNIZED DISTRIBUTORS
PLYMOUTH RUBBER COMPANY, INC.

FL 3

Announcing an exclusive new development in fibre conduit

A development of Orangeburg and Flintkote Research Laboratories, new *klean-kote* Orangeburg Fibre Conduit has a tough, non-brittle protective coating for cleaner, safer handling. To you and your men, this literally means cleaner hands, cleaner clothes and little or no chance of irritation. In addition, new *klean-kote* travels better, weathers better—and makes a stronger-than-ever joint.

Nothing has been changed in the traditional fine quality of the Orangeburg product. New *klean-kote* is just what the name implies — *a clean coating.* Beneath it lies the same quality product, manufactured with the same painstaking care which has made Orangeburg the best-known, best-selling line in America. Ask your wholesaler to show you a length of new *klean-kote* Orangeburg now.

Cleaner hands · Cleaner clothes · No irritation

klean-kote*
ORANGEBURG®
Fibre Conduit

FLINTKOTE

Orangeburg Manufacturing Co., Orangeburg, New York. Division of The Flintkote Company, Manufacturer of America's Broadest Line of Building Products

*KLEAN-KOTE IS A TRADE-MARK; U. S. PATENT APPLIED FOR. ORANGEBURG KLEAN-KOTE IS DISTRIBUTED BY GRAYBAR ELECTRICAL CO. AND GENERAL ELECTRIC SUPPLY CO. WITH BRANCHES AND STOCKS IN PRINCIPAL CITIES.

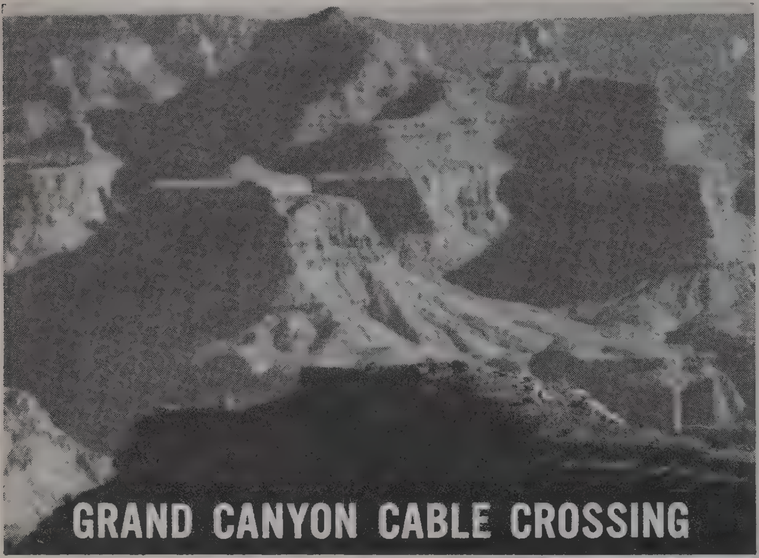
insist on...

Genuine RIDGID

THE RIDGE TOOL COMPANY, ELYRIA, OHIO, U.S.A.

News about

B.F.Goodrich Chemical *raw materials*

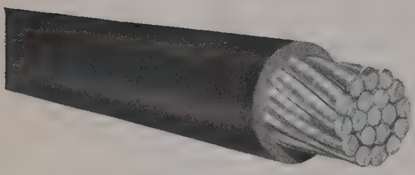


Helicopter handles stringing of ACSR insulated with Geon

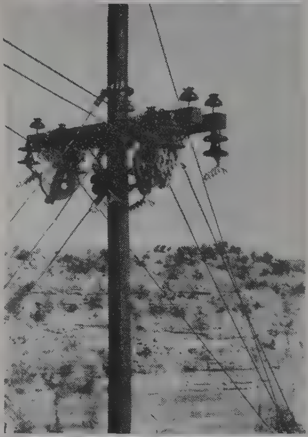
Length of spans and difficulties of terrain created problems for Arizona Public Service Company in this 75,000-ft cable stringing job on the southern rim of Grand Canyon. The longest of the 20 spans is 3000 ft, with an elevation drop of 1800 ft.

With helicopter handling and other tough installation and operation problems, selection of Geon vinyl for insulation is a natural. Geon is tough. It withstands abrasion and provides the kind of resistance to weathering and heat that gives satisfactory service for severest operating conditions. Dielectric properties are excellent. Geon also provides another advantage: it was easy to color this insulation black to match the rock formations of the canyon wall.

Here's another example of the way that Geon vinyl solves product problems—reasons many manufacturers use Geon to improve products and open new markets. For more information, write Dept. GY-7, B.F.Goodrich Chemical Company, 3135 Euclid Ave., Cleveland 15, Ohio. Cable address: Goodchemco. In Canada: Kitchener, Ontario.



75,000 ft *of 101,800 CM, 12/7 ACSR cable with a 2/64th inch covering of Geon vinyl was supplied to Arizona Public Service Company by Kaiser Aluminum & Chemical Corporation. B.F.Goodrich Chemical Company supplies the Geon vinyl.*



Geon
VINYLS

B.F.Goodrich Chemical Company
a division of The B.F.Goodrich Company

B.F.Goodrich

GEON vinyls • HYCAR rubber and latex • GOOD-RITE chemicals and plasticizers

Spang Headerduct will feed electric, telephone and intercom wiring into floor cells on 28 of the 32 floors at First City National Bank Building, Houston, Texas. This will provide service wherever it's needed and permit speedy changes to meet any future requirements.

In 1990 this Spang Headerduct wiring system will be as modern as it is today!

Houston's new First City National Bank Building is prepared electrically for any future requirements

Nobody knows what kind of electrical service the tenants of First City National Bank Building, Houston, Texas, will need in the year 1990. But this new building will be able to handle their requirements through this SPANG Headerduct system.

Over 31,000 ft of SPANG Headerduct have been installed from the second through 29th floor of the 32-story building to carry electric power, telephone and intercom wiring under the floors.

Future wiring requirements can always be made quickly, because the wiring is accessible by removing the SPANG Headerduct access box covers. This eliminates costly digging into concrete, repairing and redecorating. Cellular floor cells carry the wiring from the headerduct to all parts of the floor at regular intervals, providing convenient wiring service wherever it's needed.

PLAN FOR THE FUTURE WITH SPANG

SPANG Underfloor Duct systems help builders stay modern longer. The engineered design of these products simplifies installation and assures a lifetime of satisfactory service. To suit your requirements, you have a choice of Standard Underfloor Duct, Double-Capacity Duct and Headerduct—plus a complete range of service outlet fittings. For complete information mail the coupon below.

Architect: Skidmore, Owens & Merrill, New York, N.Y., and Wilson, Morris, Crain & Anderson, Consulting Architects—Houston, Texas
General Contractor: W. S. Bellows Construction Corporation, Houston, Texas
Electrical Contractor: Fischbach & Moore of Texas, Inc., Houston, Texas
Spang Distributor: Graybar Electric Company, Houston, Texas

Steel's Symbol of strength, long life, and economy

THE NATIONAL SUPPLY COMPANY
Two Gateway Center, Pittsburgh 22, Pennsylvania
Subsidiary of Armco Steel Corporation

The National Supply Company, Underfloor Duct Department
P.O. Box 416, Pittsburgh 30, Penna.

Please send me a copy of Bulletin No. 491 entitled "SPANG Underfloor Distribution Systems."

Name ____________________

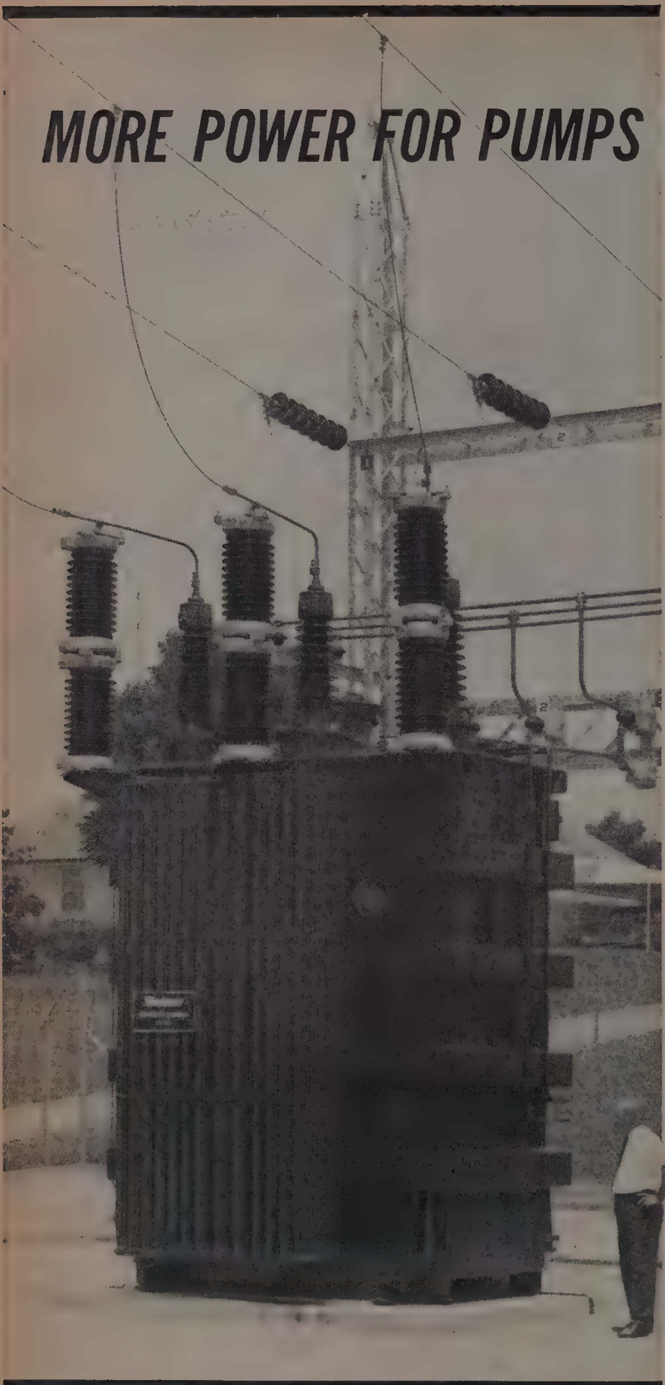
Title ____________________

Company ____________________

Address ____________________

City ____________________ Zone ____ State ____

MORE POWER FOR PUMPS THAT PUSH PETROLEUM



THIS WAGNER TRANSFORMER

POWERS-UP

PLANTATION PIPELINE

The Plantation Pipeline Company pumping station at Neese, Georgia, is part of an underground transportation system that pushes high quantities of petroleum products to their market.

The Neese operation was originally served with power from a 44 kv system substation. However, the size of the pumping load—which includes some 1800 hp motors—became too great for the substation to handle adequately.

To better serve the load, Georgia Power Company recently installed a 110 kv line and built a new substation. Wagner Electric Corporation furnished the transformer rated at 7500 Kva for this purpose. Today, Plantation Pipeline pumps with full power.

Now, what about your power needs? If they present a critical (or even a potential problem), call your nearby Wagner Sales Engineer. He'll help you plan your power program . . . suggest Wagner transformers that will meet your needs for years to come. There are Wagner branches in 32 principal cities.

Wagner
Electric
Corporation

6413 PLYMOUTH AVENUE,
ST. LOUIS 33, MISSOURI

WT60-8

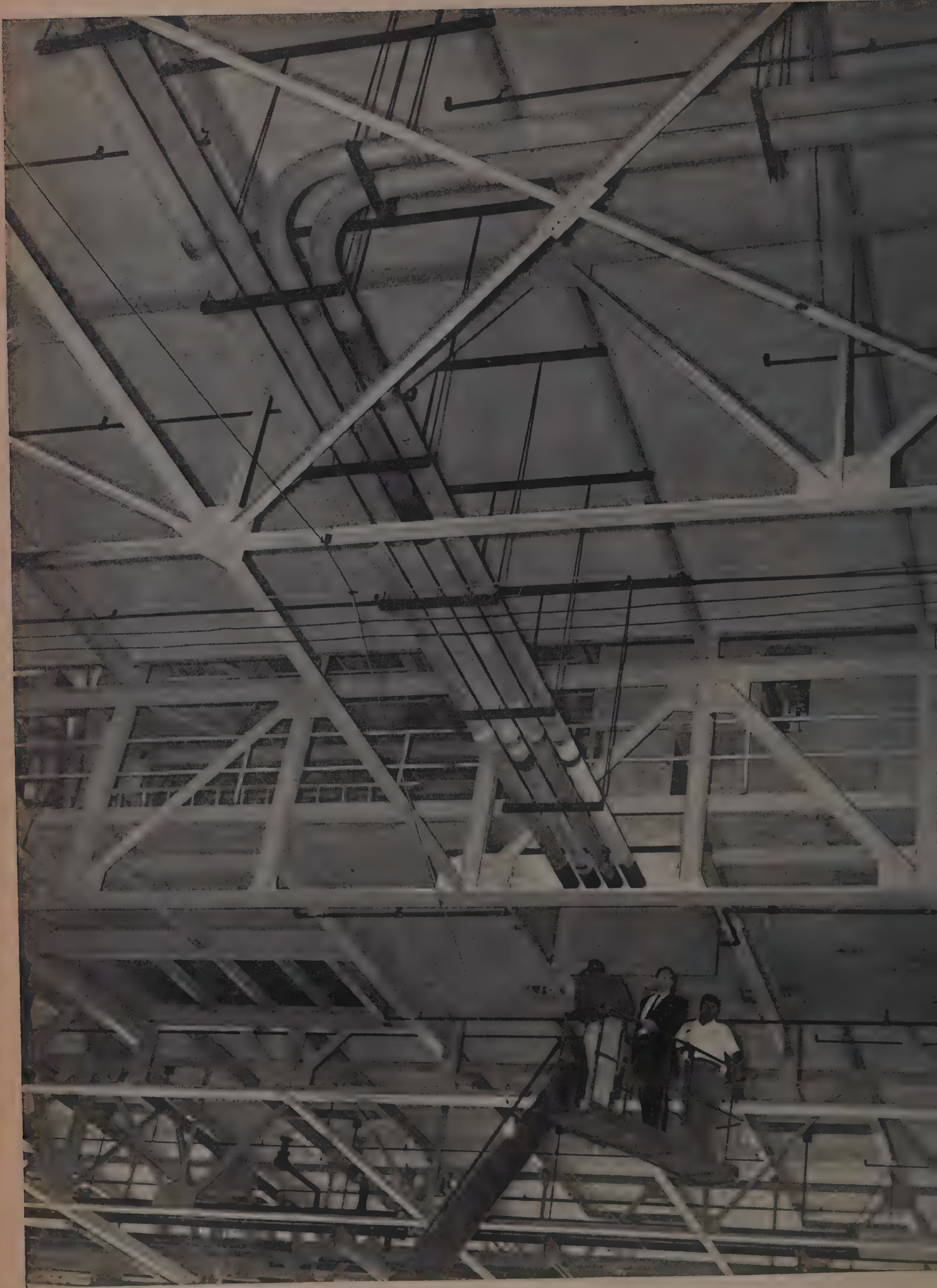
SERVING 2 GREAT GROWTH INDUSTRIES—*ELECTRICAL • AUTOMOTIVE*

NO BOLTS, NO SCREWS, NO DRILLING

with new Permacel Junction Box Mount epoxy adhesive
... the fast, easy way to attach junction boxes to any surface.

PERMACEL®

NEW BRUNSWICK, NEW JERSEY • TAPES • ELECTRICAL INSULATING MATERIALS • ADHESIVES



Watch United States Steel's special Christmas show, **The Coming of Christ,** in Color on NBC-TV, Wednesday, December 21, 8:30 P.M., E.S.T.

"Don't send a pony to do a horse's job"

A conversation you might hear around any good raceway.

Man with necktie: "WOW! It seems a lot higher once you're up here. Okay. Let's get this over with. Tell me. Why *steel* conduit instead of . . .?"

White shirt: "Mainly because steel is stronger and gives us excellent protection against damage to conductors."

Work shirt: "It's easy to install. You can thread with regular dies, and you don't need special lubricants."

Necktie: "Well, that ought to do it. I just wanted a few facts to put in a report I'm making. Let's go back down and . . ."

Work shirt: "You don't have to baby steel conduit. You can bend it without worrying about it flattening out or crinkling."

Necktie: "Fine. Okay, let's get down off . . ."

White shirt: "Steel conduit can be installed in all atmospheric conditions and hazardous locations."

Necktie: "Well, that wraps 'er up. Let's go down and . . ."

Work shirt: "You don't have to give steel any special coating for concrete installations."

Necktie: "I've never been up on one of these things before . . . feel a little shaky . . ."

White shirt: "Steel conduit provides a grounded metallic system; induced currents are drained off without danger."

Necktie: "Let's go down."

Work shirt: "Steel conduit has a smooth interior . . . makes it easy to pull and fish wires. Saves time and money."

Necktie: "Let's go down."

White shirt: "We wouldn't use anything *but* steel conduit here. You know . . . don't send a pony to do a horse's job. Okay. Want to go down?"

Necktie: "Yes . . . yes . . . steel conduit . . . certainly!"

America's leading steel pipe manufacturer supplying America's foremost conduit manufacturers.

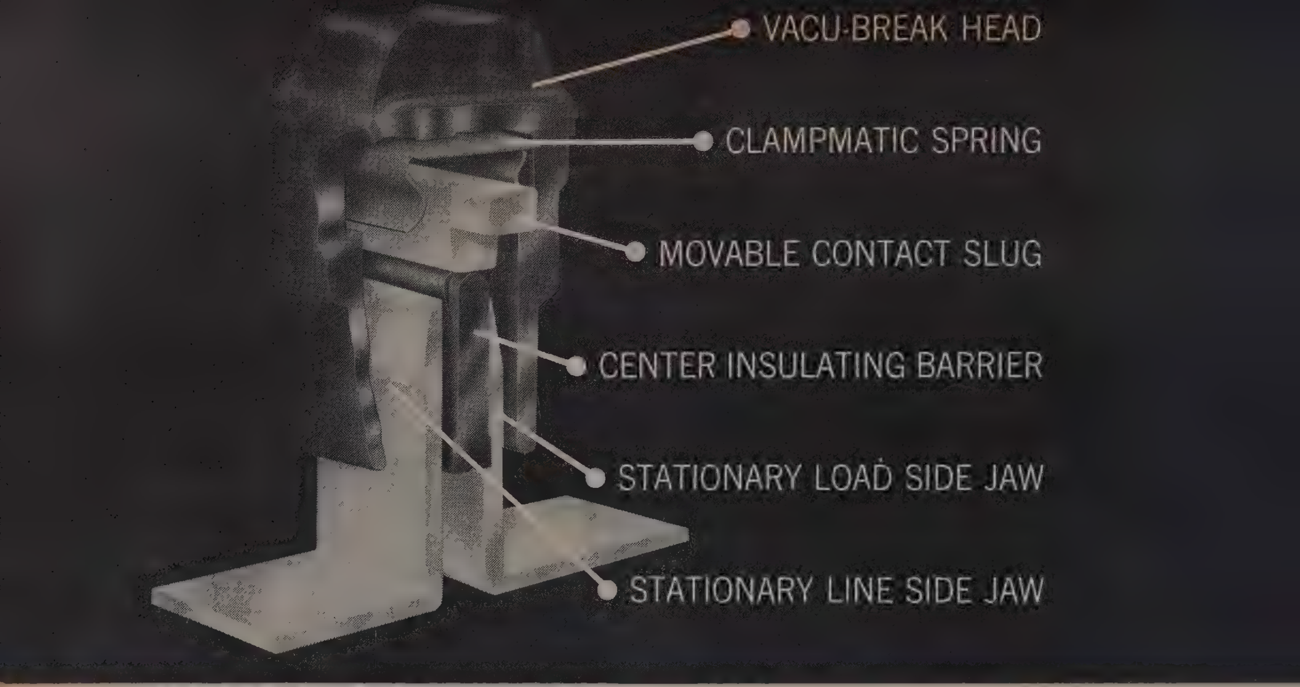
Steel

This mark tells you a product is made of modern, dependable Steel.

National Tube
Division of
United States Steel

USS

Columbia-Geneva Steel Division, San Francisco, Pacific Coast Distributors
United States Steel Export Company, New York



THE INSIDE STORY...

Why switches last longer with clamped pressure contact and Vacu-Break arc control

This BullDog Vacu-Break® Switch Head is the reason why Vacu-Break switches stay in action longer.

See how the unique Clampmatic® spring clamps the contact slug firmly between the line and load jaws . . . provides a virtual bolt-tight connection! This clamped pressure contact prevents overheating while in the "on" position—and as the switch moves to "off," the spring speeds the break. Both features mean longer switch life for your customers.

Equally important to longer switch life is the action of the Vacu-Break head. Arc chambers enclose the switching contacts. When contacts are broken under load, arcs are smothered quickly. Pitting and burning are cut to the absolute minimum, thereby minimizing maintenance.

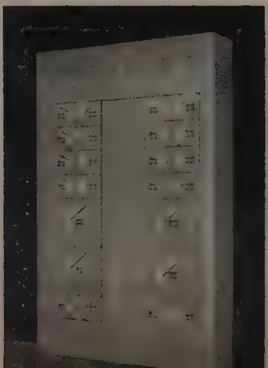
BullDog Electric Products Division, I-T-E Circuit Breaker Company, Box 177, Detroit 32, Michigan. In Canada: 80 Clayson Rd., Toronto 15, Ont. Export Division: 13 East 40th St., New York 16, N. Y.

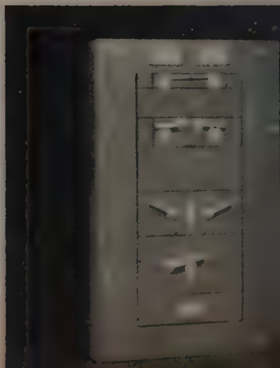
For Safety's Sake Buy Vacu-Break

BULLDOG ELECTRIC PRODUCTS DIVISION
I-T-E CIRCUIT BREAKER COMPANY

KEEP PACE ELECTRICALLY

Vacu-Break switch units with clamped pressure contacts are available in BullDog Safety Switches, Switchboards, Vacu-Break Power Panels and Bus Plugs. They cost no more and give your customers the maximum in safety and performance. See your BullDog distributor.





60TH YEAR • DECEMBER, 1960

ELECTRICAL
CONSTRUCTION
AND MAINTENANCE

Lighting as a Heat Source

Higher lighting levels are posing some important new problems in the heating and cooling of buildings. While lighting has always contributed significantly to air conditioning loads, at the new levels, the energy input into the lighted areas is approaching also the full heating requirements at maximum design temperature.

Energy input from lighting systems is distributed uniformly over the floor area. Heat losses occur, however, only at the exposed surfaces. As a result, interior areas may require cooling while perimeter areas require heating at the same time. By collecting a large part of the heat in a plenum and redistributing it to the perimeter area, an effective heating system is provided. Mixing cold air from outside with the heated air provides the control. By exhausting the heated air from the plenum, summer air conditioning requirements are substantially reduced.

A practical application of the use of heat from the lighting system to carry the full building heating load is currently being installed in a 22-story office building for the Georgia Power Co. in Atlanta. Alternative electric heating will be installed but only for night use. Some 8 watts per square foot or 90 kw per floor from the lighting system is estimated to be ample for the full winter heating requirements.

Heating and cooling is distributed by a dual duct system carrying hot and cold air to mixing boxes controlled by zone thermostats. The mixing box delivers either cooling or heating to the area or zone as required. The heat from recessed troffers which constitute the lighting system is collected in a plenum and introduced into the hot air duct system for use or exhaust as the temperature conditions may require.

As practical values of energy input to lighting systems increase to 6 watts per square foot and upward, it becomes apparent that lighting can be used to provide a significant part of heating loads. It also suggests that the heat from lighting in combination with perimeter resistance heating deserves evaluation for a good many commercial applications where the use of electric heat has not been considered heretofore.

Wm. T. Stuart

REPUBLIC
RIGID STEEL
CONDUIT

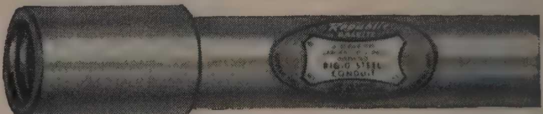
built-in quality puts a dollar in your pocket

Quality products and skilled craftsmanship go hand-in-hand to make a good looking job—and put a dollar in your pocket!

Republic ready-for-the-job *steel* conduit is easy to use, saves installation time, assures trouble-free service . . . because quality is built in.

Made of highest quality, soft, ductile steel, and produced by Republic's famous continuous weld process, Republic Steel Conduit pays off in lower installation costs—with uniformity, ductility, and freedom from hard spots. Clean, free-running threads. Clean inside surface. Tight, hot-dipped galvanized finish will not flake, peel, or chip off.

Craftsmanship can be fun again. If you like to make a profit, you'll like Republic Rigid Steel Conduit. Available from your electrical distributor.



GALVITE® RIGID STEEL CONDUIT (Blue Label) is a heavywall, hot-dipped galvanized conduit with a special coat of baked-on lacquer inside and out for greater corrosion-resistance and long life. ENAMELITE® Rigid Steel Conduit (Red Label) heavywall conduit is protected inside and out with a baked-on coating of tough, wear-resistant enamel for greater protection against moderate corrosive action.

This STEELMARK of the American Steel Industry tells you a product is made of Steel. Look for it when you buy.

REPUBLIC STEEL
STEEL AND TUBES DIVISION
Cleveland 8, Ohio

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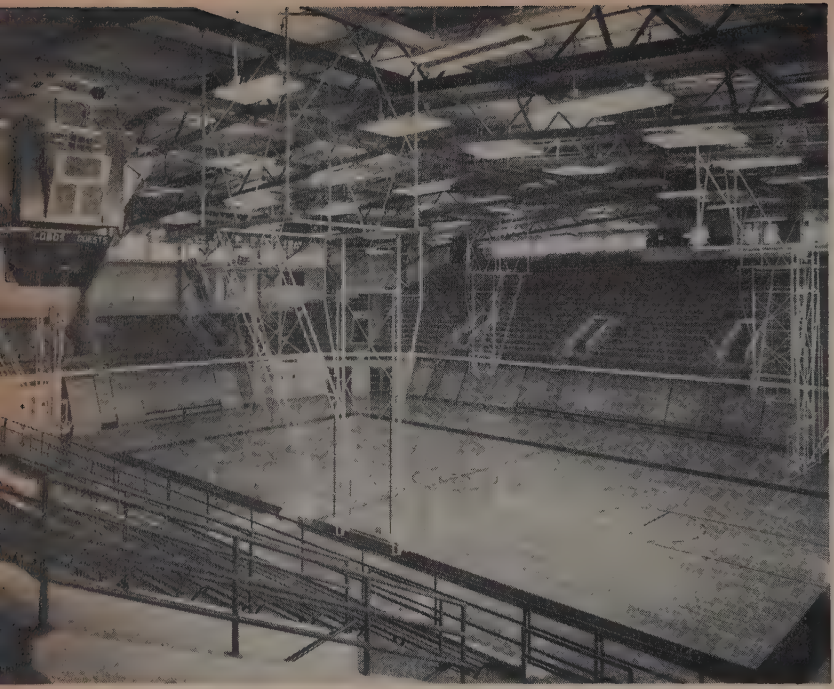
PUEBLO-STYLED GYMNASIUM at University of New Mexico contains main arena with seating capacity for 6000 spectators, also smaller auxiliary practice gym and natatorium. High-cycle high-voltage lighting plan can provide four levels of illumination. Electrical installation includes primary transformers, two m-g voltage and frequency converters, also small storage batteries with automatic transfer switch for emergency use.

High-Cycle Gymnasium Lighting

Frequency, voltage and mounting-heights are all above normal in the University of New Mexico's gymnasium, where 10-lamp fluorescent fixtures operating at 400 cycles and 600 volts are mounted 42 ft above floor level. Lower than normal, however, are wire sizes, power consumption and operating charges. Designed by Carl R. Albach, consulting electrical engineer of Santa Fe, the system was installed by City Electric of Albuquerque.

THE University of New Mexico's Johnson Gymnasium is an impressive $2-million structure containing a main arena that seats 6000 spectators around an acre of playing floor, an auxiliary gym about a quarter this size, also a natatorium. These three areas, designed for competitive activity, are lighted by 8-ft slimline fluorescent lamps operating at 400 cycles and 600 volts. And, in the main arena, multiple switching of fixtures provides four levels of illumination: 5 footcandles for minimum security purposes; 10 for general student gatherings; 30 for basketball practice; and 50 for league competition. As noted on an accompanying equipment plan, these various levels of illumination are obtained by using various lamp combinations in 2-, 6- and 10-lamp special fixtures mounted between 39 and 42½ ft above floor level.

In planning this layout it was observed that previous high-cycle installations (at Union College in Schenectady, N. Y., and in the Convention Hall at Camden, N. J.) had incorporated 14 and 18 lamps in single unit assemblies. Investigation has revealed, however, that units of such massiveness had introduced several problems; as, for example, resultant sizes creating crating and shipping difficulties, and resulting weights suggesting problems related to winch-and-cable support. Guided by these observations, this installation was limited to ten lamps per fixture.



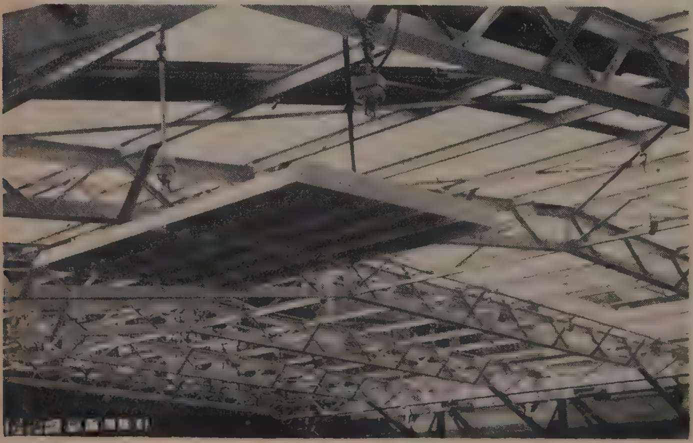
MAIN ARENA is surmounted by lighting fixtures variously containing ten, six or two lamps. Lowering cables, related to 4-pole disconnecting hangers, extend to manually operated winches positioned along central overhead catwalk. Note electrical scoreboard at left, mounted on monorail to permit lateral removal from arena when competitive games are not in progress. Press booth is seen at upper right.

By referring again to the fixture layout, it will be noted that the main arena is lighted by 44 2-lamp fixtures located above seating areas, plus 20 6-lamp and 16 10-lamp units mounted above the playing floor. All lamps in all fixtures are used to obtain the maximum intensity of 50-fc, while four lamps in the 10-lamp fixtures are turned off when only 30-fc is required. To provide 10-fc, all 2-lamp fixtures plus the center 2-lamps in the larger units are placed in operation, thereby simulating a complete 2-lamp installation. And, when minimum security lighting is permissible, only alternate fixtures are used.

These various lighting levels may be selected from either of two locations; a master control panel in the manager's office activating contactors controlling all circuits; a panel in the main-arena press booth controlling lights in the larger gym only. And both panels contain switches for the remote starting of two high-cycle generators.

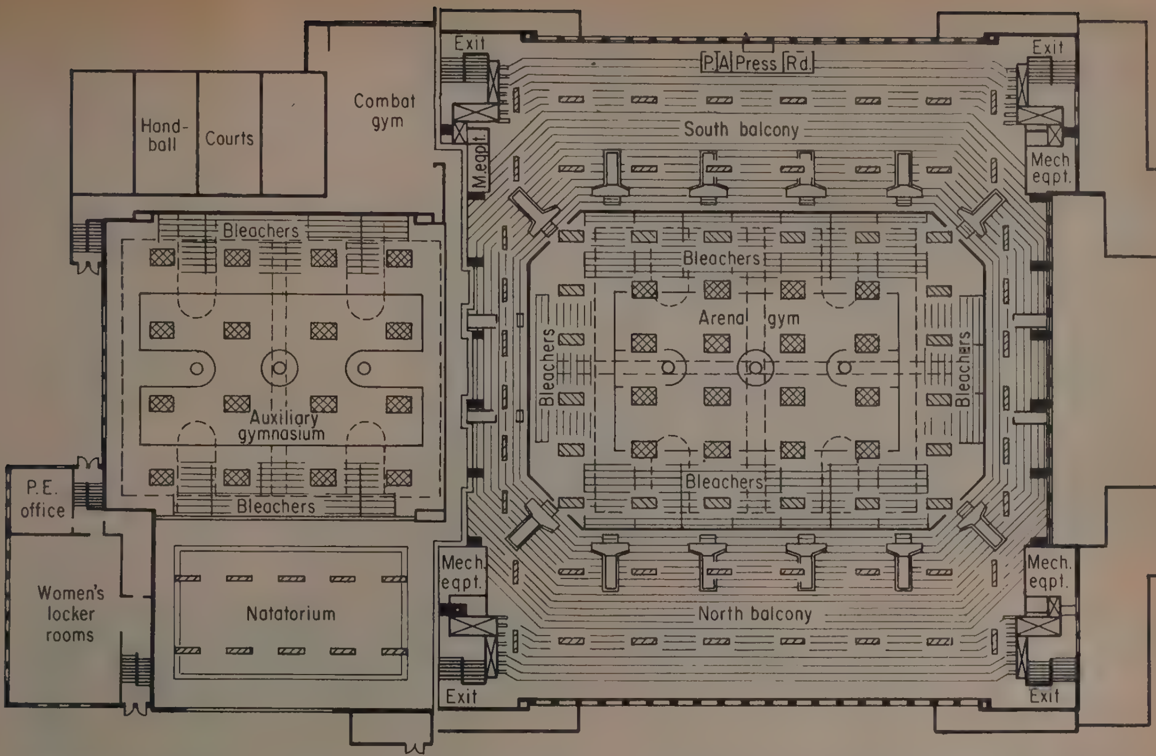
Since the manager's office is centrally situated with viewing windows overlooking the competitive areas, lighting may be readily adjusted to existing requirements. And, since both pushbutton stations are "off limits" to unauthorized personnel, all except qualified persons are excluded from control points and generator room.

When preliminary planning for this installation began, high-cycle experience and reference data was scarce. Therefore this plan was developed by searching for basic information, then equating "educated hunches" with theoretical formulas. This involved progressive steps of studying all available data concerning existing fixtures and utilization coefficients; modifying such fixture data to meet criteria established for this specific installation; selecting desired levels of illumination; determining room dimensions; establishing mounting heights; determining total number of lamps required, the maximum number of lamps to be incorporated in a typical over-court fixture, the resultant number of fixtures required and their spacing pattern. Since this problem involved several theoretical values for not-yet-designed fixtures, it was gratifying when final test readings of the completed installation came within 2% (on the conservative side) of the theoretical coefficients.

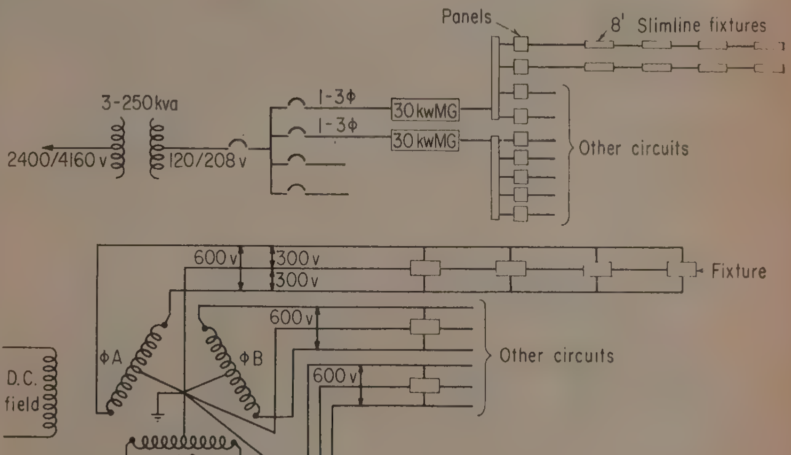


TEN-LAMP FIXTURE, supported by two 4-pole disconnecting hangers, is raised into position above center court of main arena. Multiple switching and circuiting permits unit to be used as a 10-, 6- or 2-lamp fixture, as desired. Weight of fixture was initially estimated to be 158 lbs, although fixture actually used weighed only 140 lbs.

LOWERING CABLES, related to disconnecting hangers, are carried laterally to series of manually operated winches mounted along railings of central overhead catwalk.



THREE BASIC FIXTURES are utilized in this high-cycle lighting plan. Ten-lamp units installed over the two gymnasium playing floors (shown as cross-hatched oblongs); 6-lamp fixtures over main-area bleachers, and 2-lamp assemblies over arena balconies and natatorium. Frequency converters and switchgear are in room between arena and natatorium.

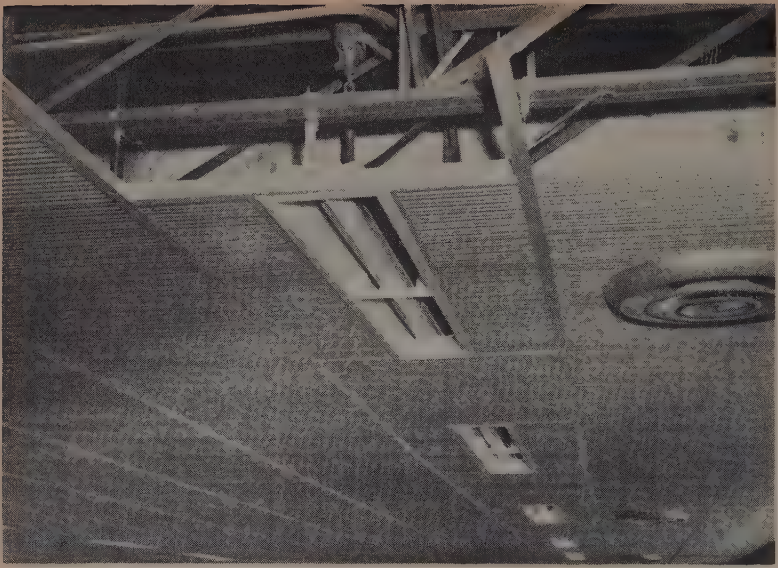


SIMPLIFIED DIAGRAM, sketched at top, indicates physical relation between transforming and converting equipment required to obtain high-cycle power for slimline lighting fixtures in New Mexico gymnasium. Lower detail shows how generator windings are arranged into single-phase groupings; mid-points being grounded and carried to each lighting fixture.

In selecting 400-cycle 600-volt motor-generators for this installation, it was reasoned that two units would be preferable to one in order to insure at least partial lighting in the arena in the event of a breaker tripping. Economics also suggested that a generator smaller than 30 kw would be impractical on a dollars-per-kw basis. For these reasons, two 30-kw units were installed; one serving all 6- and 10-lamp fixtures mounted above the court in the main arena, while the second unit serves all 2-lamp fixtures (in arena and natatorium) plus the 16 10-lamp fixtures located in the smaller auxiliary gym.

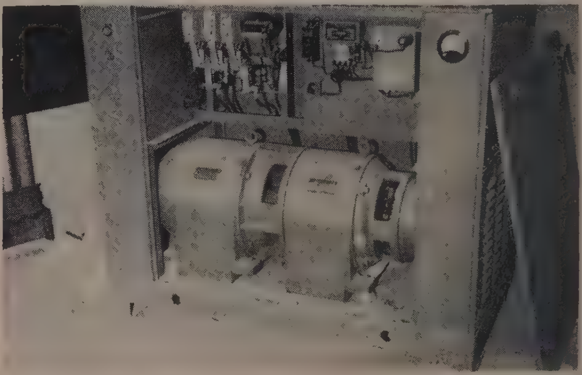
Each of these 600-volt generating units is served by a 3-phase feeder from the main 120/208-volt switchboard in the basement, with generator windings arranged into three separate single-phase groupings; each grouping having its own circuit breaker and each winding being brought out to a terminal block as a 6-wire assembly. In addition, to comply with NEC voltage limitations, midpoints of all windings are connected to ground and brought out as a seventh wire, thereby meeting the code's 300-volts-to-ground limitation. This common ground wire was then carried to each lighting fixture in accordance with specifications.

Should the main 2500-amp breaker at the central switching center trip out (stopping both 400-cycle m-g sets), independent 60-cycle circuits would maintain illumination in exit and aisle lights. Should normal utility power be interrupted to these independent 60-cycle circuits as well, automatic transfer switches at each unit would then activate additional emergency battery-operated 2-lamp units at exits and stairwells.



2-LAMP FIXTURES over swimming pool are recessed into suspended ceiling, although this photo (taken with several ceiling panels removed) shows existence of disconnecting hangers in truss area of roof structure. Lowering cables extend laterally to wall lines, then downwards through wall-enclosed raceways to wall-flush key-locked anchor boxes.

CONTROL PANELS for high-cycle lighting system are installed in manager's office (that overlooks the competitive sports areas) and in main-arena press booth. Panels contain pilot lights, also on-and-off pushbuttons related to two motor-generator sets plus various lamp combinations.



400-CYCLE motor-generator sets are housed in louvered enclosure located in room beneath main-arena balcony. Contactor for remote operation of this unit is seen at upper left. Two such units are provided to insure against complete outage of high-cycle lighting.

Location of generators involved still other considerations, because a remote position was desirable in order to isolate shrill generator noise (that could be heard distinctly through ventilation louvers of the containing room) although a *too*-remote location would involve higher drops in voltage on distribution circuits.

Another design decision was related to maintenance, for it was debated whether to install catwalks to permit overhead relamping and cleaning of permanently-installed fixtures, or to provide disconnecting hangers so that fixtures could be lowered for these necessary operations. The latter method was used and, due to the number of circuits and ground wires involved in the 6- and 10-lamp fixtures, the hangers selected were 4-pole units.

These hangers were designed for estimated weights of 158, 95 and 32 lbs respectively for 10-, 6- and 2-lamp fixtures, although, primarily due to the subsequent availability of lighter-weight fixtures, the actual fixture weights proved to be 140, 90 and 26 lbs, thereby improving resultant hanger safety factors.

In routing branch circuits, conductors are first carried in conduit from hanger locations to three overhead wireways extending along roof purlins, thence down to panels in the generator room where they connect to generator leads via contactors which are remotely controlled from the two already-mentioned pushbutton stations. Circuits were balanced between panels and phases so that maximum unbalance under full-load conditions is only 1.7 amps.

Initial intent to adopt high-cycle lighting was based upon several considerations: first, because load growth at the University was increasing so rapidly that it was desirable to keep wattage increments as reasonable as possible; second, because then-available information indicated that about 22% more light could be obtained from 10-lamp slimline 400-cycle 600-volt fixtures than from comparable 60-cycle 120-volt units; and third, that a high-cycle fluorescent installation would have an over-all economic advantage of at least 10% over an incandescent-mercury combination providing the same levels of illumination.

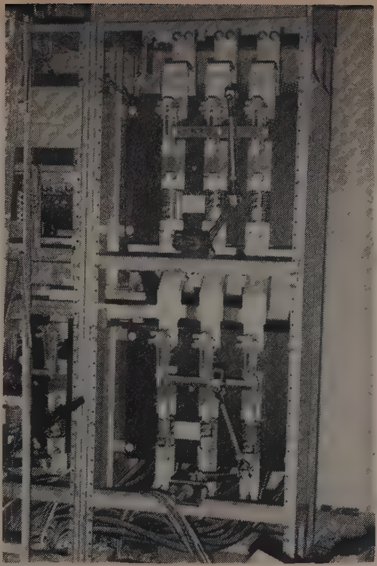
Subsequent surveys verified these assumptions. For example, it was found that by increasing frequency from 60 to 400 cycles and voltage from 120 to 600 volts, light output of an 8-ft slimline lamp was increased from approximately 4,900 to 6,000 lumens with a corresponding increase in wattage from 74 to 90. This indicated that four slimline lamps operating at 400 cycles would produce approximately the same lumen output as would five lamps operating at 60 cycles, and that an 8-ft slimline operating at 400 cycles would produce 16 more lumens-per-watt (66 vs 50) than would a 400-watt mercury-vapor lamp (neglecting ballast losses).

Another advantage pertained to ballast weights, for a 2-lamp 400-cycle ballast weighed only 35% as much as a 2-lamp 60-cycle unit.

Savings were also related to wiring, as indicated by the fact that the longest run (of 230 ft) involved a voltage drop of only 1% when the maximum branch-circuit load of 9 amps at 600 volts was carried over a No. 12 circuit. Had voltage been 120, this same ampere loading would have doubled the voltage drop although requiring a No. 6 circuit. The savings in wire and conduit sizes are obvious.

One final comment concerns the use of large multiple-lamp banks of fluorescent lamps rather than more-conventional continuous rows of fixtures. Since mounting heights of 40 ft or more were being considered, and since fluorescent fixtures generally result in wide-spread emission of light, it was initially questioned whether such units would be feasible. It was reasoned, however, that large-area fluorescent fixtures would not create high spots of brightness, as would concentrating-type incandescent or mercury reflectors, and that the flight of a ball could be followed more easily by spectators and players as a result. This, also, proved true.

As pointed out by Jack Campbell of G. E. (at the 1959 IES Conference in San Francisco), high-cycle lighting still is in the experimental stage and semi-conductor power sources ultimately may prove more efficient than rotary types for obtaining frequencies in the order of 1000 to 3000 cycles. However, such units cannot yet compete economically with converters in the 400- and 840-cycle range. And, with research and development in this field continuing, it seems likely that new generators, fixtures and ballasts will add new benefit to this type of illumination.



3-PHASE FEEDERS carry 60-cycle 208-volt current through circuit breakers to 400-cycle 600-volt m-g converters. Exit and aisle lights are served by separate panels and feeders to insure continuity of these important lighting elements in case of high-cycle interruption, while further insurance against complete lighting outage is provided by small storage battery units.

CONTACTORS, electrically operated and mechanically held, are provided for the remote control of 400-cycle lighting in the natatorium and two gymnasiums. Wiring between contactor assemblies and high-cycle converters is via 4- by 4-in. wireways. Contactor panels are also connected via wireways to circuit breaker panels, one of which is noted at right of photo.

ALL CIRCUIT BREAKERS in 400-cycle panels are rated for 14 amps 400 cycles and 600 volts. Lighting load in University of New Mexico's gymnasium was precisely balanced so that maximum unbalance on 400-cycle generators under full-load conditions is only 1.7 amps. Breaker enclosures are surface-mounted against concrete-block walls. Note racked series of square wireways on ceiling.

Personalities At NECA Meeting

Members and guests take over famous Las Vegas Strip and Convention Hall for 59th Annual Convention of the National Electrical Contractors Association, October 23 to 27. For the convention report see page 135.

H A. Webster, T. Frederick Jackson, Inc., Long Island City, N. Y.; Whitworth Ferguson, Ferguson Electric Construction Co., Inc., Buffalo, N. Y.; J. M. Watters, Jr., Lord Electric Co., Inc., New York, N. Y.; W R. Grasle, W. R. Grasle Co., Portland, Ore.; Howard Bailey, Industrial Elec. Co., Seattle, Wash.; O. H. Taylor, Taylor Electric Co., Toledo, Ohio; D. B. Clayton, Sr., Electric Constructors, Inc., Birmingham, Ala.; George Gamp, Gamp Electric Co. ,St. Louis, Mo.

Dorsey Wallace, Wallace Electric Co., Atlanta, Ga.; Harold Bannister, Motor City Electric Co., Atlanta, Ga.; Horace Hembree, Cotton States Electric Co., Atlanta, Ga.; E R. DuBose, White Electrical Construction Co., Atlanta, Ga.; J. A. Beck, Eastern Electric Co., Baltimore, Md.; R. R. Ecker, Empire Electric Co., Pasco, Wash.; J D. Drake, Drake Electric Co., Jackson, Miss.; J. T. Martin, Martin Elec. Co., Jackson, Miss.; R. J. Reitz, Jr., Reitz Elec. Co., Las Vegas, Nev.

Alvin Lobert, Romanoff Electric Corp., Toledo, Ohio; Leo Haas, Haas Electric Co., Inc., Toledo, Ohio; H. C. Winklemann, Kaemmerlen Electric Co., St. Louis, Mo.; J. A. Hitchcock, Paul Wendt Electric Co., St. Louis, Mo.; E. B. DeFeyter, Power City Electric Co., Spokane, Wash.; J. A. McCoy, McCoy Electric Co., Portland, Ore.; B. B. Hurd, B-H Electric Co., Chicago, Ill.; J. R. Meehan, Fischbach-Moore & Morrissey, Inc., Chicago, Ill.

Ernest Forsberg, Wasatch Electric Co., Salt Lake City, Utah; Don Taft, Burke Electric Co., Salt Lake City, Utah; W. N. Tune, Bond Electric Co., Nashville, Tenn.; H. L. Harlan, Ramsey Electric Co., Nashville, Tenn ; Hilliard Travis, Travis Electric Co., Nashville, Tenn.; H. E. Becker, Wismer & Becker Electric Inc., Sacramento, Calif.; J. A. Leuver, Kaiser Aluminum & Chemical Sales, Inc., Chicago, Ill.; W. J. O'Brien, W. J. O'Brien Electric Co , Inc., Chicago, Ill.

H. T. Nack, Jr., White City Electric Co., Chicago, Ill.; J. H. Oehrig, Lindsay-Wright, Inc., New York, N. Y.; N. D. Ferguson, California Electric Works, San Diego, Calif.; H. L. Cramer, Westinghouse Electric Corp., Pittsburgh, Pa.; Carl LaMothe, Fresno, Calif.; Everett Marshall, Marshall Electric Co., San Carlos, Calif.; James Sardella, S&S Electric Co., San Jose, Calif.; Paul Leslie, All-Cal Electric Co., San Jose, Calif.; G. S. Appling, Industrial Service Co., Fresno, Calif.

Wayne Oberlander, Oberlander Electric Co., Peoria, Ill.; Stam Erwin, Peoria, Ill.; Bernard Knowles, Jr., Knowles Electric Co., Atlanta, Ga.; J. E. Chambers, Bagby Elevator & Electric Co., Atlanta, Ga ; D. L. Knowles, Knowles Electric Co., Atlanta, Ga.; Dewey Smith, Dewey Electric Co., Ventura, Iowa; J. M. Schroeder, Midwestern Electric Construction, Inc., Grand Forks, N. D.; Joseph McAtee, The Electric Power Equipment Co., Columbus, Ohio; J. W. Albright, Triangle Electric Co., Detroit, Mich.; Milton Nadelberg, Lightning Electric Service Co., Newark, N. J.

H. G. Martin, Herbert G. Martin, Inc., Yonkers, N. Y.; Charles Prindle, Nyack Electric Co., New City, N. Y.; J. N. Corbin, Corbin-Dykes Electric Co., Phoenix, Ariz.; G. C. White, Empire Electric Co., Inc., Ft. Worth, Texas; A. L. Bush, Belmont Electric Co., New York, N. Y.; C. P. McGovern, Emerson-Garden Electric Co., New York, N. Y.; J. L. McGrath, IBEW, LaPorte, Ind.; M. J. Sweney, Sweney Electric Co., Gary, Ind.

C. W. Moseley, R. H. Bouligny, Inc., Charlotte, N. C.; R. C. Pflueger, Jr., Pflueger Electric Co., New Orleans, La.; John Nunez, Maritime Electric Co., Inc., New Orleans, La.; W. C Ellis, Walter J. Barnes Electric Co., Inc., New Orleans, La.; T. L. Watson, Jr., Watson Electrical Construction Co., Wilson, N. C.; Jack Mihalovich, Dahl-Beck Electric Co., San Francisco, Calif.; B N. Voss, Circle-L Electric Co., Tulsa, Okla.; Philip Stinchcomb, Philip Stinchcomb, Inc., Baltimore, Md.; W. F. Taylor, Schoonover Co., Inc., Mountainside, N. J.

GIANT FORD PLANT assembles 1,200 cars a day. Located on a 250-acre site in Lorain, Ohio, the massive plant is the most modern facility in the automotive industry.

Electrifying "Most Modern" Automotive Plant

Ford's new Lorain, Ohio, assembly plant used special techniques in electrical planning and installation including 13.2-kv distribution and ungrounded 480-volt delta secondary power. Large painting facility required Class 1, Group D explosion-proof equipment. Central controls direct parts to final assembly.

By **J. Rees**, *Plant Engineer, Lorain Assembly Plant*
The Ford Motor Company, Lorain, Ohio

FORD Motor Company's new assembly plant at Lorain, Ohio, the most modern facility in the automotive industry, is also the latest in electrical planning and installation.

Located on a 250-acre site overlooking Lake Erie, the new plant represents the composite thinking and experience of Ford's engineering staff and is designed to assemble 1,200 vehicles a day.

The 1,800,000 sq ft plant has a capacity of 15,000 kva and its primary utility service is at 138 kv.

Ohio Edison brings 138 kv to an outdoor substation located adjacent to the plant. Here, two 7500 kva oil-insulated transformers step down the 138 kv to 13.2 kv. A 138-kv, 3-pole, pneumatically operated oil circuit breaker, rated at 1200 amps, protects the substation. The station also has three 600-amp, 161-kv, 3-pole, group-operated, disconnect switches with horn gaps and two similar units without horn gaps.

Nine station-type lightning arrestors are installed. Each of three is connected to each phase of the incoming 138-kv line just ahead of the OCB. Each of the remaining six is connected to each leg of the 7500-kva transformers.

From the main step-down transformers, 15-kv cable extends underground to primary switchgear, located in a boiler house nearby. Primary cable is 750 MCM, 3-conductor, shielded, with lead-covered non-migrating paper insulation.

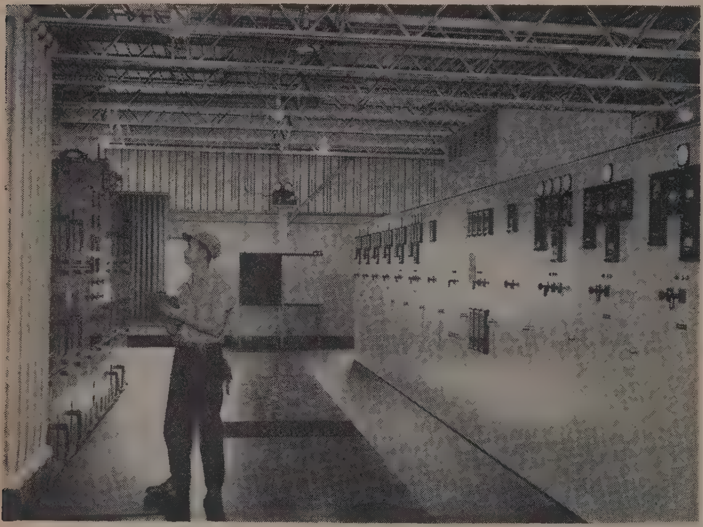
The primary switchgear consists of an inline, two-section circuit-breaker switchboard containing 16 cubicles. Auxiliary equipment includes various ammeters, protective relays and circuit-breaker test cabinets. A bank of storage batteries supplies emergency tripping power for circuit breakers, and a battery charger maintains correct voltage at all times.

From the primary switchgear, 350 MCM, 15-kv cables supply 13.2 kv to each of six unit-substations. Strategically located in various areas, these unit subs provide utilization power at 480 volts.

Located in separate rooms adjacent to the assembly area, two unit substations with a combined total of ten 1500-kva transformers supply power to the commercial body construction, passenger body construction and paint departments.

Four other unit-substations are on the roof of the plant. Each of three contains two 100-kva transformers which serve the main assembly areas and plant utilities including ventilating, air conditioning and heating units. The fourth substation, containing one 100-kva

138 KV SUPPLIES outdoor substation. Large transformers in the foreground are each 7500 kva. At the top of the superstructure horn-gap disconnect switches provide isolating and disconnecting means.



PRIMARY SWITCHGEAR is at 13.2 kv. From here, feeders supply six unit substations located in various parts of the plant. Storage batteries provide emergency tripping power for circuit breakers.

PAINT KITCHEN, code-classified as Class 1, Group D hazardous area, supplies ten spray booths by pressure feed or circulating systems. All fittings and lighting fixtures are explosion-proof.

transformer, supplies the administration building.

Air-cooled, dry-type unit-substation transformers reduce 13.2 kv to 480 volts for distribution in an ungrounded delta-connected system. Ground detectors are installed throughout the plant and if an accidental ground occurs, a crew of specially trained electricians follow a well-planned procedure to remove the ground.

Both 3-phase and single-phase transformers supply lighting and miscellaneous equipment. Three-phase, 208Y/120-volt transformers serve most of the lighting load, while single-phase 120/240-volt transformers energize other lighting loads and miscellaneous circuits.

The paint department is unique because it is the most elaborate and spacious facility of its type in the auto industry. More than 300,000 sq ft throughout the plant are assigned to painting, masking, drying and cleaning operations. And over 3,800 gal. of enamel and primer—or enough to paint 650 average size homes—are used daily at Lorain.

The heart of this operation is the paint kitchen where incoming barrels of paint replenish 22 storage tanks, which supply various areas. Both pressure feed and circulating systems supply 10 spray booths located at points along the assembly line. At each spray booth, the operator may select any of 13 passenger or commercial body colors at all times.

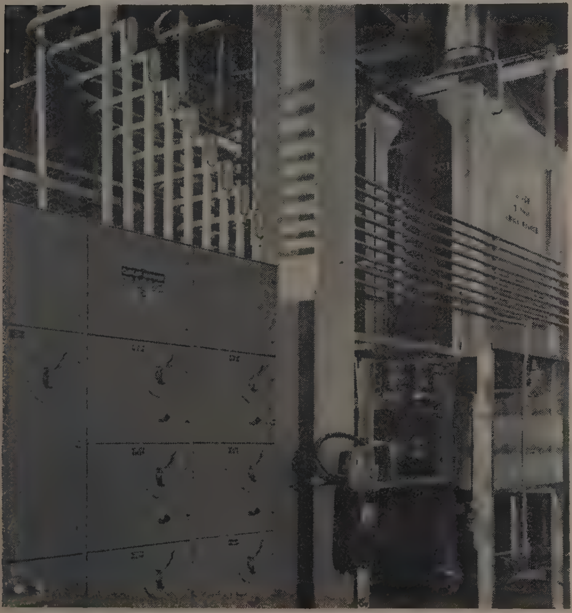
Because of flammable paint fumes, the paint kitchen is classified as a Class 1, Group D hazardous location. As a result, engineers specified special lighting fixtures and explosion-proof equipment including switches, connectors, junction boxes and telephones.

In paint storage rooms, 3-pole, explosion-proof receptacles and plugs provide outlets for maintenance purposes and for operating paint-shaker machines.

Undercoating operation areas are also classified as Class 1, Group D hazardous locations. Here, assembled cars are driven over a pit and an operator applies the undercoating from beneath the car. Because of the presence of flammable fumes in this somewhat confined location, all electrical equipment and fixtures are the explosion-proof type. Two-lamp explosion-proof fluorescent fixtures illuminate this area.

THREE-POLE, EXPLOSION-PROOF RECEPTACLES and plugs provide outlets for maintenance purposes and explosion-proof switches energize paint-shaker machines in paint storage room. Because of flammable fumes, paint storage room is classified as a Class 1, Group D hazardous area.

TWO BANKS of sealed fluorescent fixtures illuminate final assembly line. Because final inspection is so important, high-intensity lighting is required at all times. To maintain high-intensity lighting, these closely spaced, dustproof fixtures have glass covers which can be rapidly cleaned.



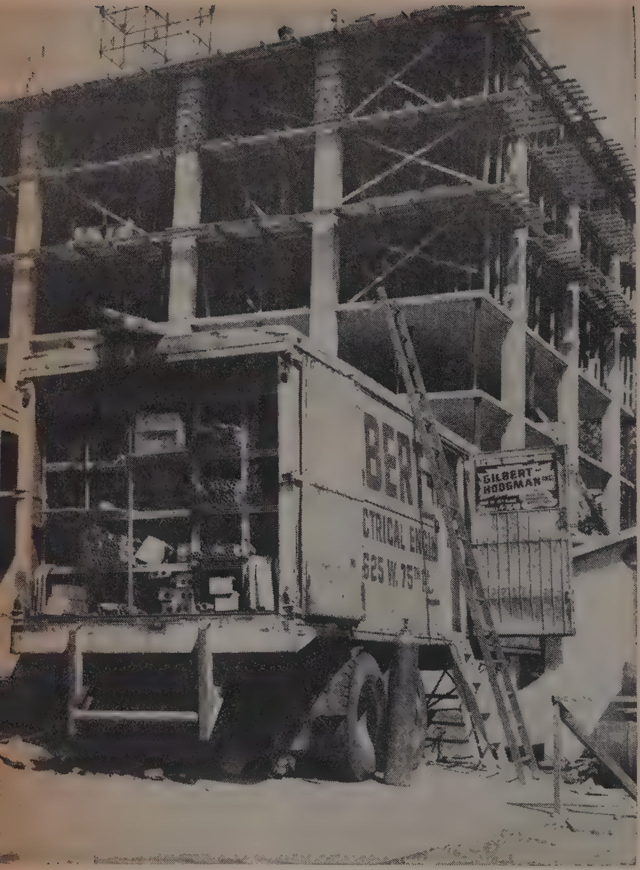
MOTOR CONTROL CENTER is typical of the many complex installations throughout the plant. Secondary power is at 480 volts, 3-phase, delta, ungrounded. In the left foreground, note the built-in ground detector. Ground detectors are spotted throughout the plant.

FORD ELECTRICIANS lower two 400-watt mercury-vapor floodlights with ease. Lowering device simplifies relamping and maintenance; allows immediate relamping without special elevating equipment. Door on base of pole provides access to cables and dry-type transformer.

An elaborate communication system—ample to handle the needs of a medium-size city—accelerates movement of various component parts to the final assembly line and insures their arrival at the precise moment they are needed. The nerve center of the communications system is a central control room where vital information about the car or truck to be assembled is fed into a master teletype machine. From the control room, data are relayed to 17 receiving stations at strategic points in passenger car build-up areas or to 14 stations in the truck assembly area. In this way, each automobile is built to special order as to color, undercoating and special accessories.

For security lighting, 400-watt mercury-vapor floodlights with medium-beam reflectors provide illumination to a depth of 100 ft from the building. On the 2-story section of the assembly building, each floodlight has a lowering-device to facilitate relamping. Contactors in various lighting panels simultaneously energize all outside floodlighting units.

Mounted atop 40-ft poles, four 400-watt mercury-vapor floodlights with medium-beam reflectors illuminate the extensive parking areas. Each pole is equipped with dry-type transformers and a lowering-device to facilitate maintenance and relamping of floodlights.



LOADED TRAILER parked at construction site combines warehouse, field shop and office in single mobile unit. Section from side door to front is shop and office area.

STORAGE SECTION occupies rear half of trailer; can be easily unloaded and loaded from rear; provides 25 protected "pigeon holes" for conduit and wiring accessories.

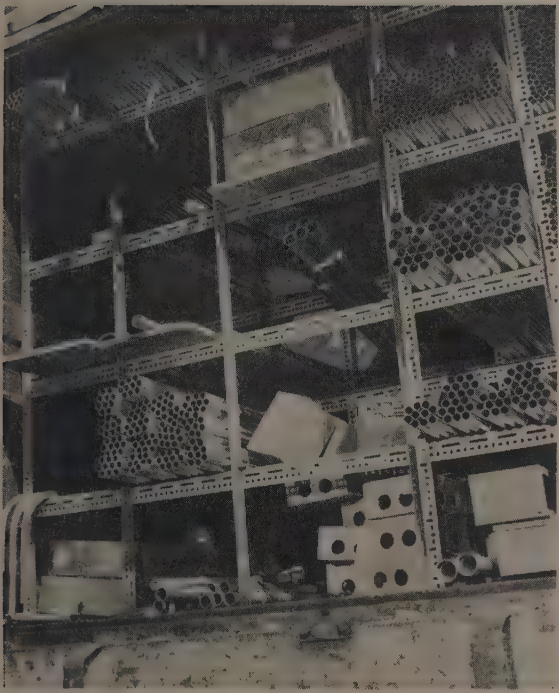
Mobile Construction Centers Save Time

IT IS an accepted fact that basic mechanics play a vitally important role in every electrical construction project. Wiring materials and components must be stored, assembled, fabricated and installed at the job site. Field office facilities are necessary to handle a variety of paper work, field engineering and to maintain contact with headquarters. Wherever possible, centralized field facilities are used to effect efficient job management and control. That is why the familiar job-shanty was the first structure or equipment to appear on a construction site.

Today, highway semi-trailers are supplanting the shanty as an economical, mobile field construction center. They are loaded to capacity at headquarters with initial construction materials; driven to the job site; and parked at a convenient, accessible spot. Some contractors use them primarily as an equipment storage facility; others use them as a field office. Many combine both functions in a single unit and even add a field shop. Outfitting the trailer interior is a matter of personal preference with layout varying according to specific use.

Typifying a multi-purpose application is the field trailer of Gilbert-Hodgman, Inc., Chicago electrical engineering and contracting firm. Parked between a building wall and the sidewalk, the 35-ft long unit provides a centralized field headquarters for the firm at a new 20-story apartment building. One half of the trailer is used for equipment storage. The other half is divided into a workshop and field office. In all, about 250 sq ft of rectangular space is occupied in an accessible area out of the traffic lanes of other trades on the job.

Dual doors at back of the trailer provide loading and unloading access to the material storage section.



SLOTTED-ANGLE sections in criss-cross pattern form storage "pigeon holes" across width and height of trailer body. Bolted connections are easy to change, if desired.

SHOP SECTION and office area are in front half of trailer. Unit has 100-amp electric service; 30 to 50 footcandles of fluorescent lighting in shop and office areas.

. . . and provide combination field-shop, office and warehouse facilities for electrical contractor. Here's how Gilbert-Hodgman, Inc., Chicago, outfitted trailers to meet their requirements.

Center doors at the sides provide personnel access to the shop and office sections. There are no interior partitions. A removable service mast terminates in a 100-amp distribution center serving lighting and receptacles for power tools and an electric welder, if required. Fluorescent units provide about 30 footcandles of illumination over the shop area; about 50 footcandles over the plans board and desks. Telephones provide a communications link with headquarters and suppliers.

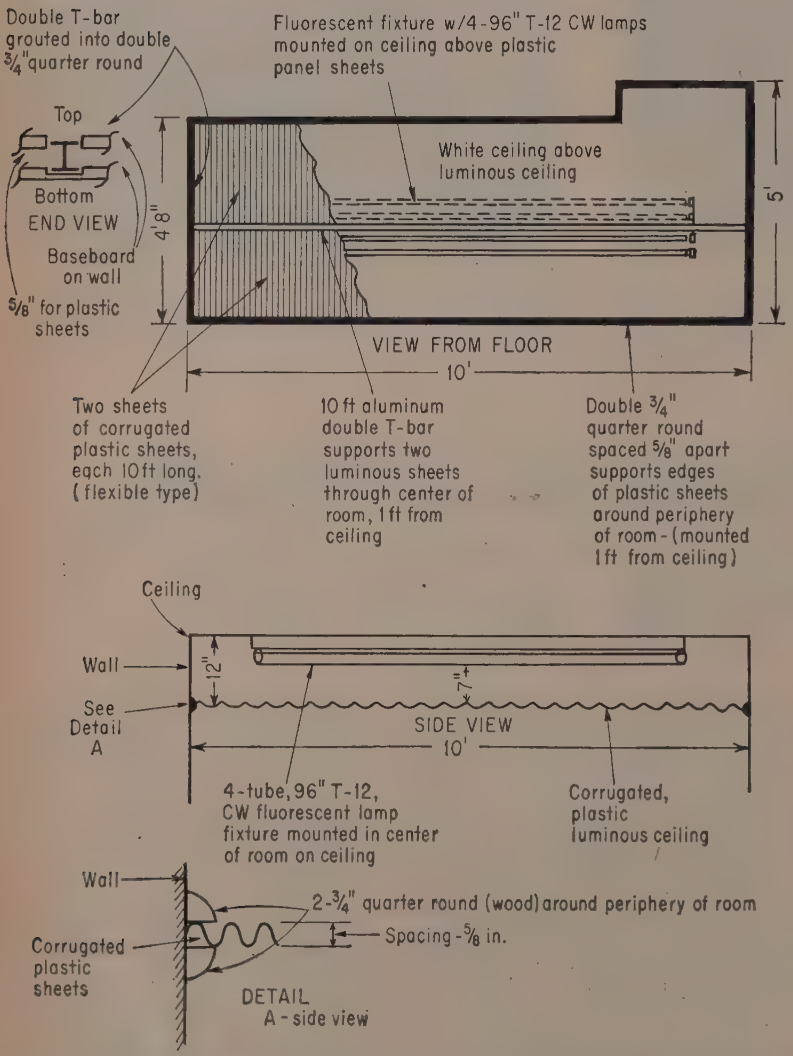
A unique rack arrangement provides storage facilities for conduit, boxes and other wiring accessories. The entire width, length (10-ft rear section), and height of the trailer are criss-crossed with sections of slotted-angle framing to form 25-long storage "pigeon holes." Conduit and EMT are laid directly on the cross-bars. Boxes and accessory cartons rest on removable plywood shelving. The storage section can be reached either from the back of the trailer or from the shop section up front.

Both headquarters personnel and mechanics like this centralized concentration of field activities. When one project is completed, the trailer is merely reloaded at the shop and sent to another job with everything in readiness. In fact, the mobile construction center works so well that G-H has two more semi-trailers in the 30-ft to 35-ft class similarly equipped to serve several large jobs at the same time.

In addition, the trailers have this "plus" value. With the firm name and address conspicuously painted on both sides of the unit, it is a sure bet that passers-by can't help but notice that Gilbert-Hodgman, Inc., is the electrical contractor on the various installations where they are doing the electrical work.

Luminous Ceiling Aids In Selling New Homes

In a four-bedroom, two-bath model home, a luminous ceiling was installed in the master bathroom for decorative display puposes. Prospective home buyers were so enthusiastic over the resultant effects that the builders decided to include this lighting with the basic purchase price of the home.


Double T-bar grouted into double ¾" quarter round
Fluorescent fixture w/4-96" T-12 CW lamps mounted on ceiling above plastic panel sheets
Top
Bottom
END VIEW
Baseboard on wall
⅝" for plastic sheets
White ceiling above luminous ceiling
4'-8"
5'
VIEW FROM FLOOR
10'
Two sheets of corrugated plastic sheets, each 10 ft long. (flexible type)
10 ft aluminum double T-bar supports two luminous sheets through center of room, 1 ft from ceiling
Double ¾" quarter round spaced ⅝" apart supports edges of plastic sheets around periphery of room - (mounted 1 ft from ceiling)
Ceiling
Wall
See Detail A
12"
7"
SIDE VIEW
10'
4-tube, 96" T-12, CW fluorescent lamp fixture mounted in center of room on ceiling
Corrugated, plastic luminous ceiling
Wall
2-¾" quarter round (wood) around periphery of room
Spacing -⅝ in.
Corrugated plastic sheets
DETAIL A - side view

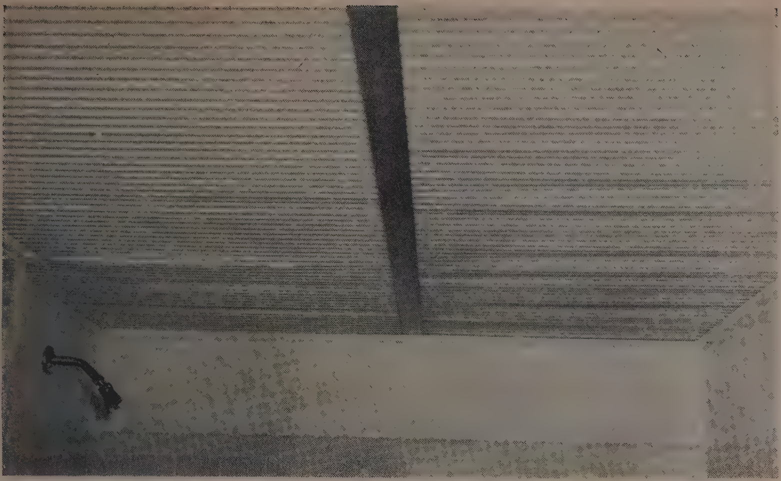
DETAILED CONSTRUCTION is shown in the drawings for a luminous ceiling installed in the master bathroom of a Long Island model home. This unique lighting technique was popular with prospective home buyers and helped to sell the homes.

THE firm of Partrick and Neisloss are well-known builders in East Huntington, L. I., N. Y., having built a number of successful medium-priced developments in addition to many custom-built homes. One of their major sales attractions has been to dress up their model homes with the best in interior decorations and furnishings. This shows the prospective buyer what can be included in a basic house initially or later on to produce the utmost in pride and satisfaction.

When the firm decided to build their latest 4-bedroom, 2-bath model ranch home, they called in their electrical contractor, Kassay Bros. Inc., Smithtown, N. Y. They explained that they wanted to accent the main bathroom, which contains a full mirrored wall above a vanity-type sink. What they were after was a unique lighting presentation to blend in with their modern bathroom furnishings and decorations.

After discussing various lighting arrangements, Paul Kassay, vice president of Kassay Bros., suggested a luminous ceiling. His suggestion was to place a fluorescent fixture with four T-12, 96-in., cool-white lamps directly on the center of the 4-ft 8-in. by 10-ft bathroom ceiling. He then suggested that a corrugated, frosted-plastic diffuser ceiling be supported 1-ft below the ceiling. The lamps would be about 7 in. above the ceiling since the over-all depth of the fixture was 5 in. The builders liked the idea, and authorized Kassay to use this method.

Prior to installing the fixture, the



LUMINOUS CEILING in a master bathroom of a development tract model house is a striking example of how builders and electrical contractors who offer something different to prospective buyers can be rewarded. Public reaction was indicated by increased sales, due largely to the lighted ceiling, which comes with each house as a standard item.

builders had the ceiling area painted with white paint of good reflective quality. Then Kassay installed the fluorescent fixture in the center of the bathroom ceiling. After this, corrugated, plastic diffuser panels were provided in two pieces, each 10 ft long by approximately 2 ft 4 in. wide. An aluminum "double T-bar" channel provided the center support for the plastic diffuser panels.

Wall supports for the diffuser panels consisted of two runs of ¾-in. wood quarter-round, spaced ⅝ in. apart. This also provided the support for each end of the center aluminum channel. With the use of standard wood quarter-round, instead of metal moulding for side supports, substantial savings resulted.

Accompanying photos and detailed drawings show the complete construction of the luminous ceiling installation.

After the completion of the luminous ceiling, the builders and sales representatives were immediately impressed as to how effectively it accented the entire bathroom area in bright but well-diffused cool light.

Public Reaction

When the model home was opened to the public, the luminous ceiling was marked "For Display Only." But not for long. Public reaction was so favorable that the builders decided that they would include it in the basic price of the house.

With the population explosion on Long Island, and with home buyers looking for something "extra," this scheme paid off, because none of the many competitive home developments could offer this feature. As a result, sales soared and more prospective buyers were attracted to the new model to see this new idea.

Basically, here is a medium-priced home ($17,990) with a plus feature that caught the eye of prospective buyers. Another example of public reaction to builders and electrical contractors who offer the latest in electrical techniques.

In this locality, major appliances such as cooking units, space heating equipment and water heaters are generally gas-operated. But this successful development proves that there are other items that can "sell up" the electrical installation—providing extra profit for the electrical contractor, increased sales for the builder, and satisfied home buyers.

PAUL KASSAY, vice president of the electrical contracting firm of Kassay Bros. Inc., Smithtown, N. Y., stands under the luminous ceiling he designed for the master bathroom of a new seven-room ranch model home.

SEVEN ROOM, model ranch home, located in East Huntington, L. I., N. Y., sells for $17,990 with a striking luminous ceiling in the master bathroom included in the price. Builders are Partrick and Neisloss of East Huntington, and Kassay Bros. Inc., Smithtown, N. Y., are the electrical contractors.

The Heat Factor

. . . A yardstick of heating effectiveness

by W. J. Novak

SO-CALLED "heat factors" provide a useful means by which electric heating installations and performance may be compared and judged. Such factors may take various forms; each has its function if properly understood and interpreted. In general, they may provide information on the design requirements, in the form of an installed capacity factor; and on actual metered performance, expressed as an energy utilization factor.

The Electric Heating Forum is designed to provide a means of industry-wide communication on electric heating practices and problems.

This month, the "heat factor" is presented. A recent survey among electrical contractors doing electric heat work disclosed that few had any idea of how many watts per sq ft they installed in a typical job, nor what performance they could expect of the system. Constant attention to the heat factors described here will result in quicker estimating, detection of errors, and a more complete comprehension of the possibilities of electric heat.

Readers are invited to express their opinions; relate their own experience data to the material presented; or submit new ideas, research data, or case studies on any aspect of electric heating. Please address correspondence to:

Electric Heating Forum
Electrical Construction and Maintenance
330 W. 42nd Street
New York 36, N. Y.

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Installed Capacity Factor

For years the electrical industry has designated power requirements for lighting purposes in terms of "watts/sq ft" of floor area. Standards have been set up for various types of buildings and visual tasks based on known efficiencies of light sources. Thus, installation of so many watts of power per sq ft of floor area insures sufficient capacity to provide the desired footcandles of lighting. Obviously, as light source efficiency is improved, the watts per sq ft required would be reduced for a given level of illumination.

Similarly, electric heating systems may be gauged in terms of installed watts per sq ft of floor area. One difference between application to heating and lighting is immediately apparent: desirable lighting levels are not static but are being increased as research shows the advantage of higher levels from the standpoint of both comfort and efficiency based on the specific visual task. Comfortable levels of temperature also vary with the activity of the occupants; however, maximums have long been established. Thus installed heating capacity need be no greater than that required to provide the desired temperature at expected low outdoor temperatures.

A possible exception may exist in the case of a central heating system, where reserve capacity may be desired to take care of future building additions; however, this contributes to the inefficiency of the system both from the control standpoint and through greater electrical demand.

Thus, obligations to the building owner to provide the most efficient and economical system possible behoove the designer or contractor to keep the installed watts/sq ft as low as possible consistent with the desired comfort.

How does one recognize an efficient and economical value for this factor? It can only be done by comparison with factors of other installations under similar conditions. A record of factors for previous jobs will be very helpful. For effective comparison, such data should recognize the several variables which affect the watts/sq ft factor. Since installed capacity is based on design heat loss, the heat-loss formula suggests what these variables are:

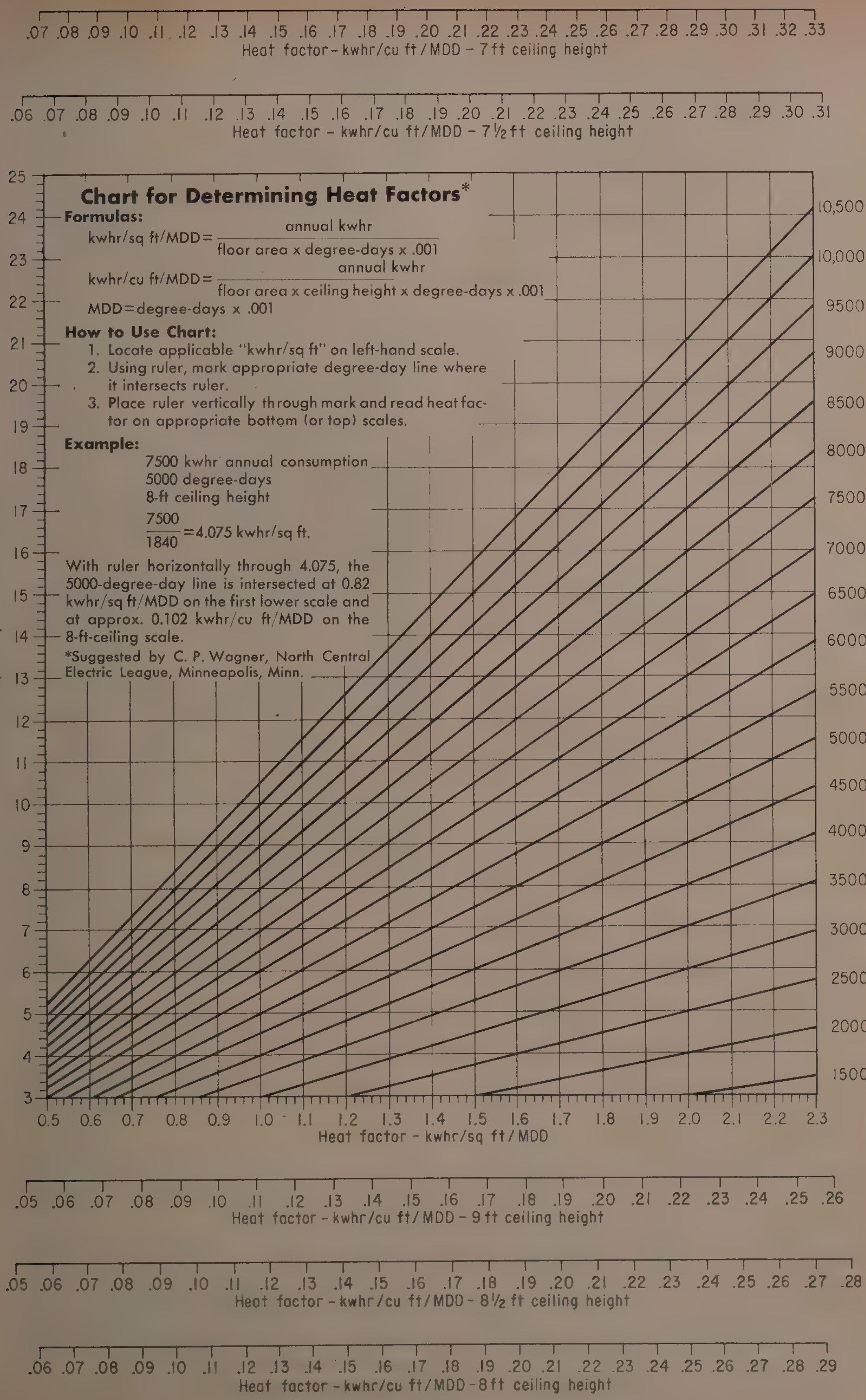

Chart for Determining Heat Factors*

Formulas:

$$\text{kwhr/sq ft/MDD} = \frac{\text{annual kwhr}}{\text{floor area} \times \text{degree-days} \times .001}$$

$$\text{kwhr/cu ft/MDD} = \frac{\text{annual kwhr}}{\text{floor area} \times \text{ceiling height} \times \text{degree-days} \times .001}$$

MDD = degree-days x .001

How to Use Chart:

1. Locate applicable "kwhr/sq ft" on left-hand scale.
2. Using ruler, mark appropriate degree-day line where it intersects ruler.
3. Place ruler vertically through mark and read heat factor on appropriate bottom (or top) scales.

Example:

7500 kwhr annual consumption
5000 degree-days
8-ft ceiling height

$$\frac{7500}{1840} = 4.075 \text{ kwhr/sq ft.}$$

With ruler horizontally through 4.075, the 5000-degree-day line is intersected at 0.82 kwhr/sq ft/MDD on the first lower scale and at approx. 0.102 kwhr/cu ft/MDD on the 8-ft-ceiling scale.

*Suggested by C. P. Wagner, North Central Electric League, Minneapolis, Minn.

Heat loss = U-factor × area × temp diff.

(1) U-factors vary with building materials and thus with types of buildings. While the effective thermal resistances of any one type of building may be relatively constant, they may vary considerably from one type to another. Thus watts/sq ft records should indicate the *type* of building (ranch-type residence, two-floor residence, school, etc.).

(2) Note should also be made of the glass area involved, preferably as a percentage of the floor area, since its relatively high U-factor can have a great effect on the installed capacity required.[1]

(3) The watts/sq ft factor is based only on *floor* area; therefore variations in ceiling height, which affect the total wall area, will affect the value of the factor. Ceiling heights should be noted for all building types.

(4) If the heating designer or installer extends his operations over a large area, design temperatures may differ; hence his records should be grouped by geographical area.

(5) Finally, the type of heating system used may affect the factor, hence it should be noted.

The All-Weather Comfort Standard[2] recognizes this difference in requirements in various sections of the country and recommends various maximum watts/sq ft factors for different degree-day areas. As is the case with any set of maximum or minimum standards, the installations should be better than the recommendations where possible, consistent with the customer's best interests.

Energy Utilization Factor

A building contractor breaks down his construction costs on the basis of dollars/sq ft of floor area for various types of buildings in different areas. A heating contractor can use a similar approach in analyzing all his jobs to (1) accumulate data useful in estimating installation costs for prospective customers, and (2) build up records of actual kilowatt-hour energy consumption for use in estimating annual heating costs.

The latter most accurately reflects the effectiveness of the system when expressed in kwhr/sq ft/1000 degree-days. Use of 1000 degree-days instead of per degree-day gives a factor greater than one, which is easier to handle. By relating the energy usage to degree-days, the resulting factors may be compared for similar occupancies regardless of geographical location. Simple multiplication of the factor by the electrical rate in any given locality will give the operating cost per sq ft.

Also in use is the relationship kwhr/cu ft/1000 degree-days, which takes into account the ceiling height. This is useful in comparing the net results of installations in similar types of buildings of different ceiling heights. However, the interests of the building owner are better served if the heat factor in terms of square feet of floor area is brought down to an established economical value. Extra ceiling height means useless space which must be heated; special effort should be made to provide more effective thermal resistance in the structure to reduce heat loss to the point where a heat factor equivalent to that obtained with normal ceiling heights may be achieved. More fundamentally, the sq-ft factor is easier to comprehend by both the installer and the homeowner.

Example: 1840-sq-ft residence; 10 kw installed capacity; 5000 degree-days; annual consumption 7500 kwhr; 8-ft ceiling height.

$$\frac{10{,}000 \text{ watts}}{1840} = 5.43 \text{ watts/sq ft}$$

$$\frac{7500 \text{ kwhr}}{1840 \times 5.000} = 0.815 \text{ kwhr/sq ft/MDD}^{3}$$

$$\frac{7500 \text{ kwhr}}{840 \times 8 \times 5.000} = 0.102 \text{ kwhr/cu ft/MDD}$$

$$\frac{7500 \text{ kwhr}}{10{,}000 \text{ watts}} = 0.75 \text{ kwhr/watt installed}$$

Summary

The engineer or contractor engaged in electric heat will profit by calculating the above heat factors not only for his own jobs, but also for others which come to his attention for which sufficient design and operating data are available. He can thus compare his operations with those of others. (The accompanying chart may be used for rapid graphical determination of heat factors either in kwhr/sq ft/MDD or in kwhr/cu ft/MDD for various common ceiling heights.)

He can also, depending upon his own ingenuity and interest, develop additional factors which will be of help. For example, the annual kwhr divided by the installed capacity in watts will give kwhr per watt, which can be used to give the annual operating cost per installed watt. (See example above.)

It is certainly possible to achieve residential installations using less than 1 kwhr/sq ft/MDD annually, with installed capacities as low as 5 or 6 watts/sq ft and annual consumption on the order of 0.5 to 0.8 kwhr/installed watt.[4] Current industry achievement at best averages about twice these values. For comparison, data taken from a recent Northwest Electric Light & Power Assn. study[5] show the following average factors for 50 homes selected at random and tested over a one-month period:

10.68 watts installed/sq ft
2.5 kwhr/sq ft/MDD.

The obvious conclusion is that the economical balance between initial cost with greater insulation vs operating cost savings deserves more concentrated study, both in the electrical industry and in the building trades, preferably jointly. An accurate industry-wide file of installation and performance data expressed as heat factors can go far to permit drawing accurate conclusions in this regard.

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[1] See Electric Heating Forum No. 4, October, 1960.

[2] See Electric Heating Forum No. 3, Sept., 1960.

[3] MDD is frequently used as an abbreviation for "1000 degree-days"

[4] See "Electric Heat Can Cost Less," April, 1960; Electric Heating Forum No. 1, July, 1960, *Electrical Construction and Maintenance*; and "The ABC's of Insulation for Electric Heating," *Electric Heating and Cooling*, Oct-Nov., 1960.

[5] See "Fresh Facts on Heating Load," *Electrical World*, August 22, 1960.

Don't Short-Change Heating In Estimating Costs

Where separate metering is not provided for electric heating circuits, the annual heating costs are often estimated by observing the power consumption during the non-heating months and prorating this consumption over the rest of the year, subtracting from the total recorded consumption.

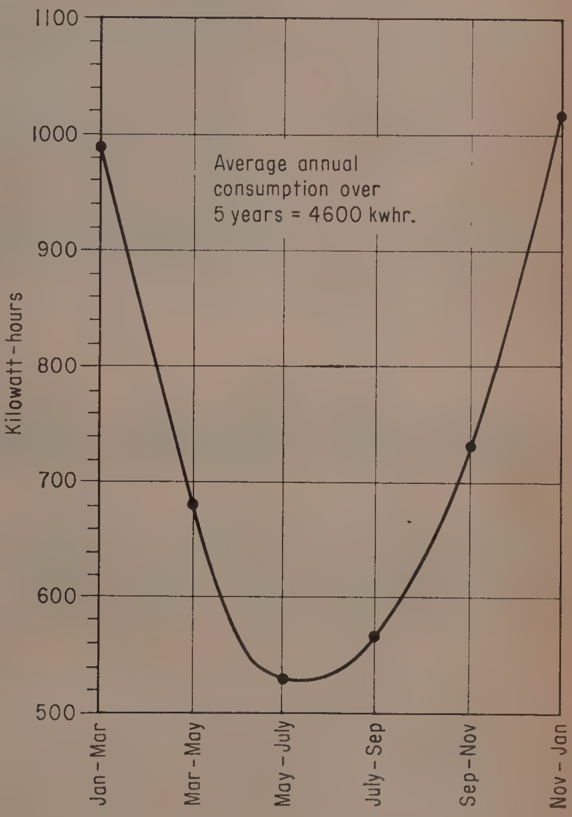
This can result in exaggerated heating costs, as shown by the accompanying curve. This curve represents average non-heating electrical consumption over a period of five years for a 1400-sq-ft split-level one-family house on Long Island. Energy consumption was metered bimonthly; each of the six points on the curve represents an average of five annual readings for that period.

The average May-to-September consumption was 1100 kwhr or 275 kwhr per month over the 4-month period. This would mean a non-heating total of 275 × 8 or 2200 kwhr for the eight heating months. But the curve shows that the actual consumption during these eight months averaged 3320 kwhr. Thus, we would be assuming that 3320−2200 or 1120 kwhr were used by the heating system over this period, while they were actually used by lighting and appliances. If the total consumption of an electrically heated home was 10,000 kwhr, this method of estimating would ascribe 3300 kwhr to lighting and appliances, 6700 kwhr to heating. Actually, the figures should be 4600 and 5400 respectively. Thus, the heating costs would be exaggerated by 1120/5400 or 21%.

Obviously, electrical consumption varies considerably over the year due to many factors such as vacations, longer daylight hours, and outdoor activities. Individual analysis in each case is desirable; only metered results should be applied to estimating of proposed installations.

Non-Heating Electrical Consumption

(Average for 5 years)



Average annual consumption over 5 years = 4600 kwhr.

EHF Articles Index

July through Dec., 1960

EHF No. 1 (July, 1960)
- *Design Heat Losses and Annual Energy Requirements*, by Glydewell Burdick.
- *Design Heat Loss and the NEMA Constant*, by Howard S. Smith and Floyd Olson.

EHF No. 2 (August, 1960)
- *Calculating Heat-Loss Factors*, by W. J. Novak.
- *Should the Utility Aid in Financing Electric Heat?* by Floyd Olson.

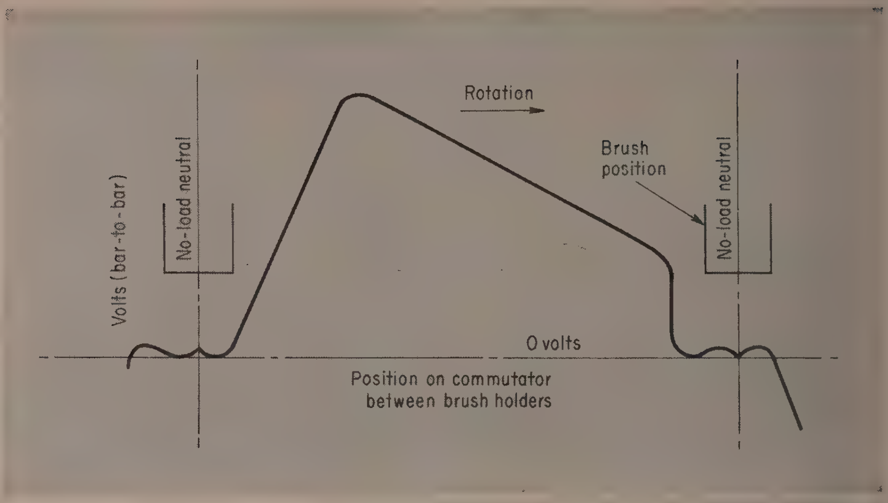
EHF No. 3 (September, 1960)
- *Fresh Air and Humidity*, by Glydewell Burdick.
- *All-Weather Comfort Standard.*
- *Electric Heating Equipment Sales, 1959.*

EHF No. 4 (October, 1960)
- *Effect of Glass Area and Framing on Wall Heat Loss*, by W. J. Novak.
- *Heat Pump Compressor Capacity Test*, by E. E. Umlang.
- *Cost Comparison: Heating Fuels and Electricity.*

EHF No. 5 (November, 1960)
- *Infrared Spot Heating*, by Lowell R. Mast.
- *Sidewalk Snow Melting*, by Aubrey G. Caplan.
- *Electric Space Heating: Outlook for 1961.*

EHF No. 6 (December, 1960)
- *The Heat Factor*, by W. J. Novak.
- *Don't Short-Change Heating in Estimating Costs.*

FIG. 1. Motor field-form curve



Brushes, Sparking and Machine Maintenance

"The little brush gets all the blame" is a statement commonly heard in the industry, but the blame is usually misdirected. Here are some of the common machine ailments and their cures, with hints on how to obtain better brush performance.

By M. S. May, Speer Carbon Co., St. Mary's, Pa.

THE much-maligned carbon brush is not responsible for most of the machine malfunctions attributed to it. Sparking at the brush face is usually the first symptom of trouble elsewhere.

To properly appraise and remedy the difficulties, the technician must understand what a brush is supposed to do and what special qualities it must have to accomplish its purpose.

Brush Qualities

(1) A brush must be a good conductor. In a dc machine the full load is carried through the brushes.

(2) It must assist the fields, interpoles, and compensating windings in reversing the current quickly as each pair of commutator bars pass under it. This means it must hold back current flowing in the short-circuited coil without, at the same time, appreciably interfering with the flow of useful load current.

(3) It must operate with low friction to avoid power losses and excessive commutator wear.

When we consider that the surface with which the brush is in contact is built up of many commutator bars separated by open slots and running at speeds up to two miles per minute or more, we begin to

FIG. 2. Motor field-form curves under brushes

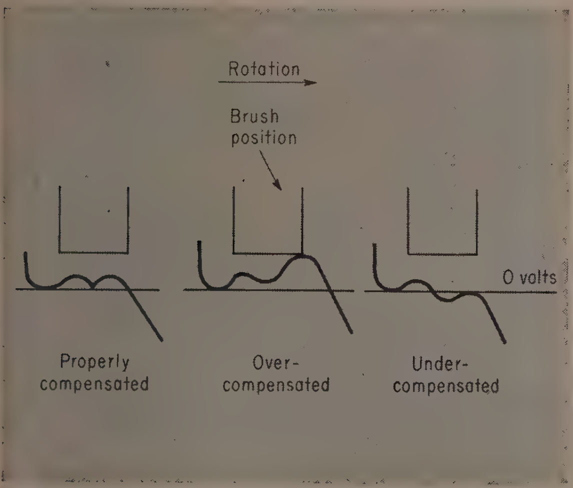
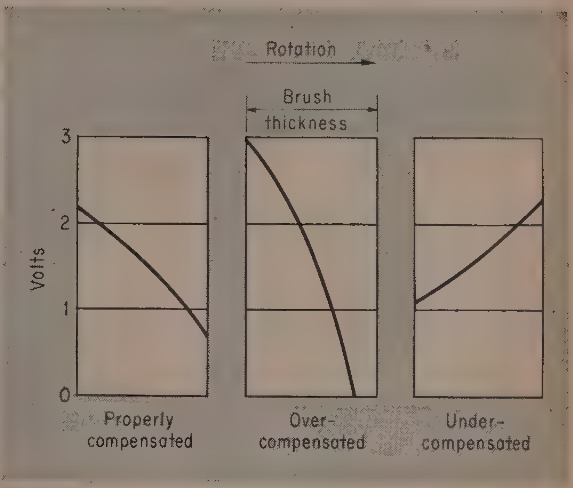


FIG. 3. Motor brush-drop curves



realize how difficult this job is, especially since the commutator is subject to distortion because of temperature changes and centrifugal forces and cannot be consistently maintained as a project cylinder.

Brushes used in the first few motors were built of copper. Before long, however, carbon brushes became standard because of their lower contact resistance, low friction against the commutator, and ability to withstand arcing.

The contact resistance or drop—the resistance offered to the flow of current between brush face and commutator surface—is normally expressed in ohms or voltage drop. It is effective in improving commutation because the load current impelled by high voltage must pass over the contact only once, while the circulating current in the short-circuited coil must pass over the contact twice and has only low voltage behind it.

Why are machines not designed so that interpoles and commutating windings take care of current reversal without any contact drop in the sliding member? This is not feasible because armature reaction varies with load and speed, and the self-inductance in the short-circuited coil cannot be eliminated by any practical design. Also, designers must make compromises to give satisfactory machine operation at minimum cost and size.

Most machines are designed so that the proper brush will give satisfactory commutation, good operating results, long commutator life, and reasonable brush life. But different machines have different brush requirements. That's why all manufacturers supply a number of different brush grades. Furthermore, operating conditions in industry are often not ideal; and proper machine inspection and maintenance are necesary if good operating conditions are to persist.

Sparking Causes and Cures

Following is a brief rundown of the more common causes of sparking, along with suggestions for their diagnosis and treatment.

Brush holders not equally spaced: This condition may appear as unequal sparking on different holders. It can be determined by counting the number of bars between holders or by putting a band of paper around the commutator, marking the positions of the brush toes, removing the paper, and measuring the distance between marks. *To correct, move the brush holders so that adjacent holders are all equally distant from one another.*

Brush holders off electrical neutral: Even though the holders are equally spaced, they may be out of their correct position and cause sparking which may be equally severe on all brushes of the same polarity. This fault can be detected by running a field form curve as described in an accompanying box. *The trouble may be corrected by shifting the brushes.*

Brush holders damaged or dirty: Any physical damage to the holder or an accumulation of dirt on its inside may interfere with the free motion of the brush in the holder and thus result in sparking. Since the commutator is seldom perfectly round or concentric, the brush must move in and out of its holder in order to maintain effective contact. Visual examination and testing the free action of the brush with the fingers are usually sufficient to reveal this condition. *Thorough cleaning or complete replacement will improve operation.*

Holders too far from commutator surface: If the holder is too far from the surface of the commutator, it fails to support or guide the brush properly. This may result in the brush cocking in the holder and binding, or in the brush vibrating and losing contact with the commutator. *The obvious remedy is to adjust the brush holders so that their nearest point is 1/16 in. to 1/8 in. from the commutator surface, depending on the type of machine.*

Wrong interpole strength: This

may be caused by a flaw in the interpole winding such as a broken wire or short circuit, or by incorrect spacing of the pole face in relation to the armature (see above). *In either event, repair or correction may be facilitated through use of field form and brush drop curves (see test procedures described below and on the following page).*

Overloads: Excessive overloads may result in severe sparking, especially if the interpoles have passed their saturation point and are, therefore, unable to increase their strength as required. If the machine has an ammeter, compare its load with the nameplate rating. *Make any load adjustments necessary.*

Underloads: Contrary to what might normally be expected, too little current flowing through the brush frequently causes difficulty. The friction apparently increases drastically at very light loads, resulting in brush vibration and very often in sparking. It sometimes becomes severe enough to break up the brushes or fray their shunts. *The remedy is to increase the load on the machine in some manner or replace it by a smaller unit. In some cases, however, the situation may be helped by changing to a high-resistance, higher quality graphite brush.*

Defective armature windings: Any defect in the windings may show up as sparking at the brushes. It will frequently also be apparent by one or more burned places on the commutator. Check for high-resistance connections where the risers are soldered or brazed to the commutator or for poor connections in one or more of the equalizers. Remember, though, that any other fault in the armature may also show up as sparking. *Where other tests verify an armature fault, the winding must be replaced.*

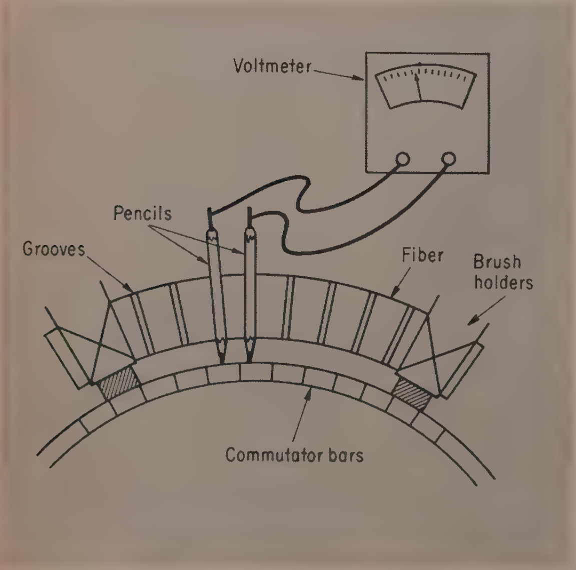
Incorrect spring pressure: Contact drop of a brush is influenced by the pressure with which it is forced against the commutator. If the pressure varies from brush to brush, those brushes carrying a higher pressure will have a lower contact drop and will tend to take more than their share of the current. This can sometimes be determined by checking the temperature of the brushes immediately after shutting down the machine. If this fault is suspected, check the spring pressure on each brush with a scale. *Adjust to the level recommended by the manufacturer.*

Poor undercutting of commutator: If the commutator has high mica or fins of mica that reach up to the brush surface, vibration and sparking may result. Similarly, any burrs of copper left as a result of the undercutting operation will cause trouble. In some locations and atmospheres, commutator slots may become filled with foreign material. This can cause the brushes to vibrate or cause ring fire by permitting current to leak through from one bar to the other. *Correction of these conditions is the solution to the problem.*

Foreign material on commutator surface: Any gummy or gritty material which sticks to the commutator surface may cause sparking. Oil may be beneficial in extremely small quantities but frequently causes gumming when used excessively. Careful examination of the commutator will usually disclose such conditions. *Thorough cleaning should be accomplished.*

Black commutator films: Abnormally dark commutators may result from sulfur, excessive humidity and other gaseous materials. This condition may cause selective action and result in sparking on the heavily-loaded brushes. *Solution of the problem may be difficult when commutator speeds are too high. A rather abrasive brush may be the answer. In other cases, frequent polishing of the commutator may be required.*

Brushes binding in holder: When



Field-Form Test

This test involves the measurement of voltages across successive commutator bars with the machine running at normal load. The readings may be taken readily using two graphite electrodes (soft lead pencils will do) insulated from each other, separated by the width of one commutator bar plus slot, and connected to a low-reading (5-volt) dc voltmeter. The pencils may be held in the hands and steadied by a piece of insulating paper (such as fiber) clamped to adjacent brush arms and cut to conform with the curvature of the armature, as shown in the sketch. Notches may be cut into the fiber to guide the pencils and insure proper separation. Readings are taken, moving the pencils around the armature between the two brushes, to provide a sufficient number of points to plot a curve such as is shown in Fig. 1, plotting voltage as the ordinate and position as the abscissa. The readings thus show the voltage between adjacent commutator bars at various points on the periphery with regard to the brush location.

brushes are not of the correct size or when brush hardware projects too far at some point, brushes may bind in their holders. Damage to holders may also cause binding. If the brushes are too tight in the holders, their proper motion will be restricted so that they cannot maintain contact with the commutator and sparking may result. If they are too small, they may wobble in the holders and thus tend to break contact with the commutator and bring about the same result. *The specific cause of binding should be determined and eliminated by repair or replacement.*

Restricted brush motion. Brush motion may be restricted because of shunt stiffness or by contact with some other member. Similarly, something may interfere with the motion of the spring itself or with the hammer by which the spring applies its pressure to the brush. *Mechanical adjustment will usually correct these conditions.*

Out-of-round commutator: The commutator may be out-of-round or eccentric because of improper finishing. As a consequence, the brush may not be able to follow the surface and maintain proper contact. Careful measurements, preferably made with the armature rotated in its own bearings, will usually disclose this defect. *The defective brush should be replaced.*

High bars or flat spots: These conditions can usually be identified by careful examination of the commutator when it is not running. A high bar will usually be polished and followed by several bars which look rough and pitted or burned. The high bar will usually result in a flat spot because it lifts the brush off the commutator and the following bars may be burned so that their height is reduced. *To correct, the commutator should be ground or turned. If the trouble develops again, the commutator probably needs tightening by an expert.*

It is sometimes observed that commutators may be perfectly round when tested cold but develop a high bar in operating under conditions of speed and load. Consequently, the problem of loose bars is not always easy to diagnose.

Machine vibration: Vibration of the machine itself may cause brush sparking and eventually result in commutator damage. Such vibration may be caused by imbalance in the armature, by poor foundations or other mechanical faults. It can also result from defective bearings. *Pinpointing the cause of vibration will indicate the corrective course to follow.*

Summary

The following general order of procedure is suggested when unusual sparking is observed at the brushes:

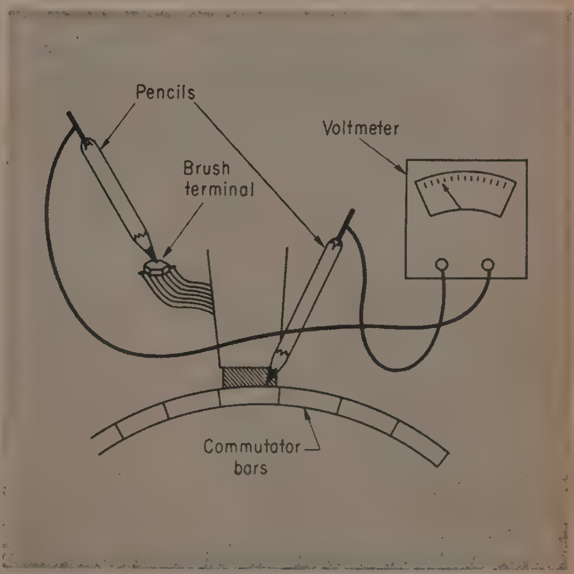
1. Check holders for damage or dirt.
2. Check brushes for free movement within holders.
3. Check springs for freedom of action and adjust the pressure on each brush.
4. Examine commutator for indications of high mica, mica fins, or "slugged" slots.
5. Examine commutator for blackened, pitted, or burned segments or areas.
6. Check the commutator for roundness and for bar-to-bar deviations.
7. Examine risers at end of commutator for indications of poor contact.
8. Run the machine at its usual load and take data for a brush-drop or field-form curve, as explained herein.
9. Examine brushes visually and tactually for vibration. (A piece of insulating material held on top of the brush is a safe way to feel its action.)
10. Check the bearings for excessive vibration.

These tests may indicate the cause of the sparking and suggest the remedy. If they do not, or if available facilities do not permit correction of the indicated difficulty, the machine manufacturer should be consulted.

The portion of such a curve under the brushes is the most significant, indicating the degree of compensation (correction for armature reaction). The compensation may be interpreted as shown by the three sketches of Fig. 2.

Brush Drop Test

By measuring the voltage from the brush terminal to various points on the commutator under the brush, we can plot a brush-drop curve. This curve illustrates the current distribution at the brush face and thus indicates the condition of the effective magnetic field. The same graphite electrode or pencil used for the field-form curve may be used for this test, as shown in sketch. The results are shown in Fig. 3 for proper compensation and for under- and over-compensated conditions.



• *ESTIMATING FORUM—VII*

Reduction of The Standard Labor Unit

By Ray Ashley, *Research and Consulting Engineer, Oak Park, Ill.*

QUESTION: *What factors permit a contractor to reduce his labor cost units during dull periods?*

ANSWER: *There are three principal reasons why a contractor can do this. They are: 1) better mechanics; 2) better support from the office; and 3) all trades move faster.*

DISCUSSION:

To evaluate the reasoning behind this answer, each category will be considered separately.

Better Mechanics. The following discussion is not intended to be a general criticism of mechanics. Its main objective is to point up variations in workday practices and compare conditions on some current projects with suggested standards and those of the 1938 era.

There is always a large percentage of mechanics who try to produce a good day's work regardless of conditions. Workmen responsible for low productivity of a crew generally are some temporary employees who, unfortunately, are not basically good mechanics. And there are men who are always ready to take advantage of the times.

If we were to grade crew productivity and use 100% as the average, we could establish these three group ratings: below 100%; 100%; and above 100%. The poor mechanic retards the work of the better men and reduces the productivity of crew with which he works. In slow times, many of the below-average mechanics are weeded out and the productivity average goes up. Factors affecting both individual and crew productivity will be analyzed in a separate article.

A study of the accompanying chart and tables emphasizes the

(Continued on page 82)

TABLE I—Variations in The Work-Day Practices**

	TIME IN MINUTES		
OPERATION	**A**	**B**	**C**
Changing clothes—in morning	15	..	..
Selecting tools and getting on job	15	10	5*
Coffee Break—9:30 AM	15	10	..
Preparation for lunch	15	10	5
Return to work after lunch	15	5	*
Coffee Break—2:30 PM	15	10	..
Pick up and prepare to leave—afternoon	20	15	5*
Sitting around waiting for 4:30	10	..	..
Relief periods	30	20	15
Total Incidental Time	**150**	**80**	**30**
Actual Installation Time	**330**	**400**	**450**
TOTAL—8-Hour Day	**480**	**480**	**480**

**—For medium size industrial projects.

*—Partially or wholly on mechanics' time.

Col. A—Conditions reported for some current (1960) projects.

Col. B—Suggested standards.

Col. C—Conditions reported for some projects in 1938.

TABLE II—Distribution of Daily Incidental Time

	TIME IN MINUTES		
OPERATION	**A**	**B**	**C**
Actual Installation Time	330	400	450
Normal Incidental Time	60	60	30*
Special Allowances (Coffee Break)	20	20	..
Wasted Time	70	..	..
TOTALS	**480**	**480**	**480**

***—Unusual condition.**

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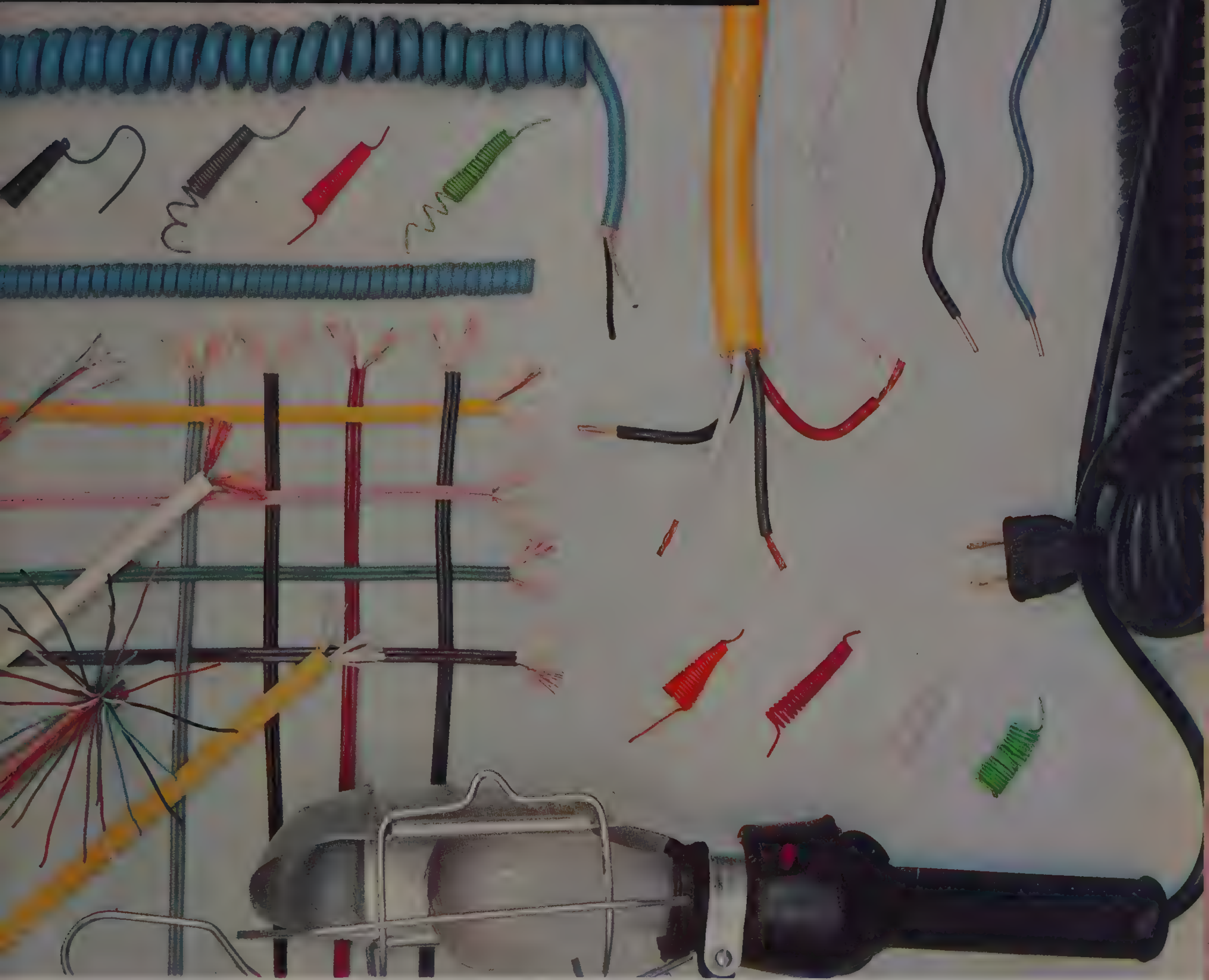

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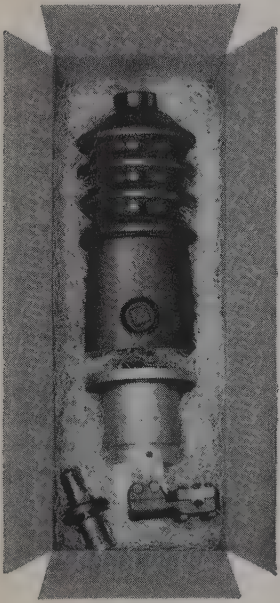

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A standard capnut pothead ready for shipment as a typical unit package.

All components and oil for three, gang-operated oil-filled cutouts are shown in this typical unit package. ▶

G&W's unique Unit Packaging program saves you time and money. Every component, device, and accessory required for the installation of a G&W standard Pothead or oil-filled Cutout is quickly gathered from "off-the-shelf", carefully and securely packaged, and sent to you *complete* in a single carton or crate. Once put into your inventory, it is a simple matter to take from stock as many individual boxes as required, load on a line truck, unpack right at the job site, and put the units into service in short order. You not only effect substantial savings on inventory control and handling, but materially cut installation costs.

Unit Packaging is another benefit you gain from G&W's constant development of cable accessories and switchgear. Further proof, too, that you are dollars ahead by relying on G&W's 55-year record of dependability and quality. A G&W representative will assist you in solving any cable accessory or switching problem, or write us for full detailed information.

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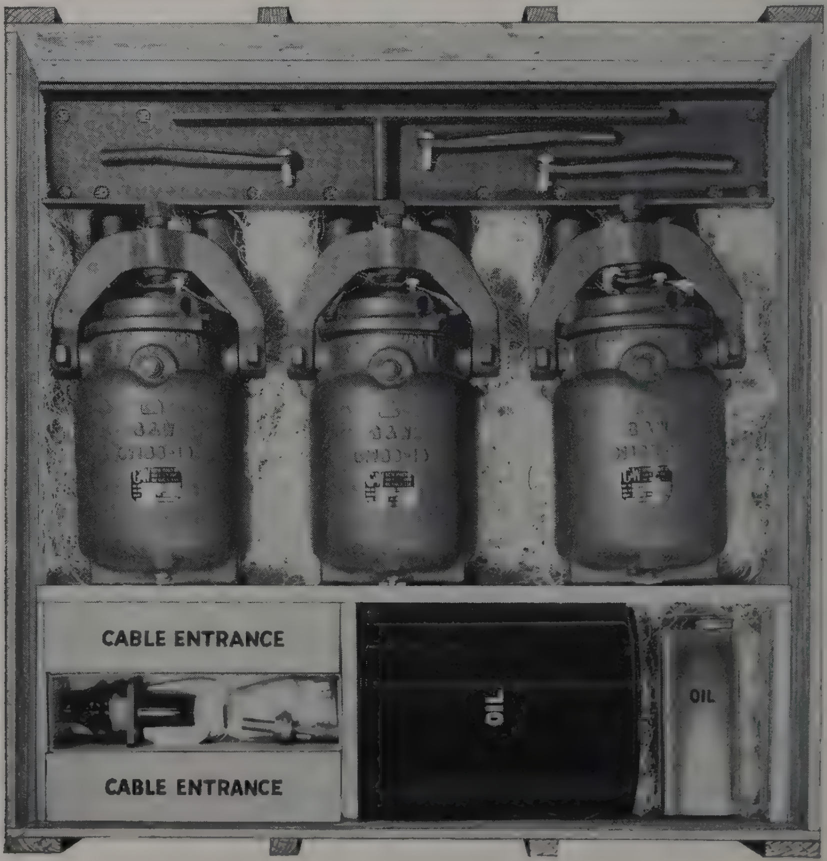

G60-2

Instrument Plant with

300 FC Lighting and Controlled Environment

- Boosts quality levels 100%
- Ups production 50%
- Cuts production costs 20%

CONTROLLED environmental conditions and higher lighting levels are paying off handsomely at the Hickok Electric Instrument Company in Cleveland, Ohio. Delicate, sensitive meters with critical tolerances and hundreds of fine parts are now assembled in a specially designed "white room" featuring controlled pressure, humidity, temperature and 300 footcandles of fluorescent lighting. Since this new room has been in use there has been a 100% improvement in quality levels, a 50% boost in production, and a 20% reduction in production costs, according to Paul P. Radecky, Hickok production supervisor.

The new assembly area, a 30-ft by 50-ft room with a 10-ft ceiling, is considered one of the finest industrial lighting installations in the U. S. by General Electric lighting engineers. Continuous rows of 2-lamp, 8-ft, cool-white High Output lamps above a vinyl plastic ceiling provide 300 footcandles of well diffused illumination on the modern, desk-like assembly line. Eye loupes formerly required for most assembly operations are now used only for final visual checks of the tiny assemblies.

Before the "white room" was built, instruments were assembled under lighting levels of a little more than 100 footcandles and in an area where environmental conditions were not controlled. Foreign and air-borne particles frequently got into the delicate mechanisms causing rejects of components and completed meters which failed to pass rigid quality tests in spite of careful inspection.

In the new "white room" these problems were solved by careful control of the atmospheric conditions. Dust is electronically removed from the air. The room itself is pressurized at a constant level

LUMINOUS CEILING provides 300 footcandles of well diffused lighting at work level in Hickok's meter assembly room; helps boost quality production and reduce production costs.

NO EYESTRAIN for critical seeing tasks under 300 fc lighting in Hickok's new controlled environment instrument assembly room. Employees no longer need jeweler's magnifying eye loupes to work.

ANTEROOM ADJACENT to pressurized instrument assembly room. Here Hickok workers don nylon robes, brush clothes with magnetic brushes (shown on ledge) and wipe their feet on magnetic door mats to prevent carrying dust or lint into assembly area.

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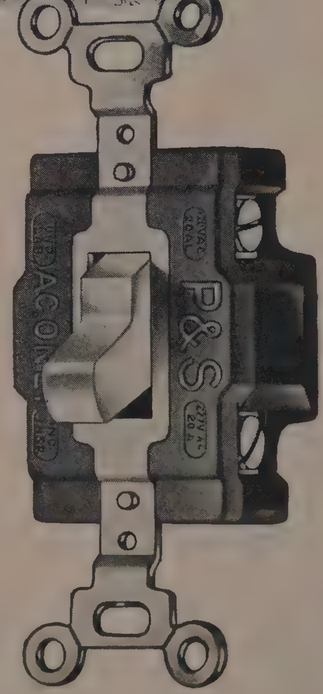
Built for Long Life...

20AC1 Super AC Switches



Modern, attractive Kroger Building, designed for many years of continuous service to downtown Cincinnati, uses P&S 20AC1-I Super AC switches. Heavy silver alloy contacts mounted at the nodal point provide long life at full-rated capacity on inductive and tungsten filament loads.

High quality 15- and 20-ampere P&S Super AC switches meet all Underwriters' Laboratories requirements, including rugged overload test of 4.8 times rated current, at 40-50% power factor and rated voltage.

As companions to P&S Super AC switches, 9260-I duplex and 5242-I grounding duplex outlets are used in the Kroger Building.

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20AC1-I

P&S PASS & SEYMOUR, INC.
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4 psi higher than surrounding areas. This keeps dust from entering windows and doors. Room temperature is held constant at 75°F and humidity is maintained constant at 45%.

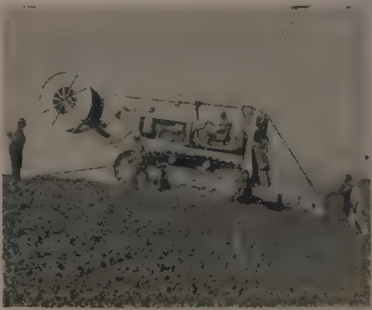
Since meters are manufactured for critical uses such as in aircraft, missiles and space vehicles, Hickok has taken every precaution to insure quality production in the "white room." Everything must be virtually dust-free and lint-free. Even the employees get special attention.

Hickok workers wear special dust-free garments (nylon robes). Before entering the "white room," they brush their clothing with magnetic brooms and wipe their feet on two separate special magnetic floor mats to guard against bringing dust or lint into the area.

Operations in Hickok's Cleveland "white room" have been so successful that the company is installing a similar 6,000-sq ft facility at its Greenwood, Miss., plant.

Underground Cable Placed by Ripper and Tractors

Electrical outfits faced with the problem of laying long runs of underground cable can profitably lift a leaf from the notebook of two Spokane contractors who recently joint-ventured a 68-mile stretch of 3-in. armored cable between Lewiston, Idaho, and Rosalia, Wash., for Pacific T&T. In several respects this run was a toughie, for it included eight highway undercrossings, a river undercrossing and a rocky mountainside having slopelines up to 45 degrees. Fortunately, however, the run also covered considerable flat farmland. And, in



TRACTOR RIG was fitted with ripper blade, reel rack, overhead pipe frame and guide sheave above driver's seat. Arms holding reel, designed and constructed by the contractors, are hydraulically operated.

Now Available...the ***EASIEST CLINCHING*** *fitting in the industry!*

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COUPLINGS AND CONNECTORS

■ Dead Soft Steel for Easy Crimping ■ Solid One Piece ■ Rolled Thread ■ Concrete Tight ■ Competitively Priced ■ ½", ¾", and 1" Sizes.

ETP makes clinching as easy as indenting butter with this new type coupling and connector. A **dead soft steel** — especially formulated and processed — is used for easy crimping. These are rugged fittings — uniformly concentric to provide easiest on-the-job wiring.

- Precision rolled thread for 65% greater strength.
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- Sparkling corrosion-resistant zinc chromate over-plating.
- Extra heavy duty lock-nuts.
- Far exceeds requirements of UL file card No. 24788.

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Ramset® Fastening System

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EXTRA PULL was provided by a second tractor operating tandem-fashion out in front. When running in flat farmland, cable-laying rig covered as much as five miles in single day, ripping ground and placing cable in one continuous operation.

THREADING cable through ripper unit was necessary every 1400 ft as one reel of cable ran out and another one was started. Cable ends were slightly overlapped to leave splicing margins. Splicing was completed by telephone personnel.

these areas, contractors Johnson (Lester N.) and Degerstrom (Neal A.) were able to check off as much as five miles a day.

This phase of the work was facilitated by mounting a ripper blade with cable-laying boot on a tractor likewise equipped with a field-fabricated set of arms that held a 1400-ft reel of cable out in front. In passing from reel to ripper, the cable was carried over a half-section pipe frame and guide sheave placed above and behind the driver's seat.

When the going got really rugged, a second tractor was hitched up in front tandem-style to put more beef in the haul. This second tractor was also used to pick up and lug extra cable reels as needed, thereby keeping the laying operation fairly continuous.

Reflecting considerable pre-planning and attention to detail, the contractors contacted all landowners along the cable route in advance to acquaint them with the nature of the work and to verify that right-of-way approvals had been ob-

MAKE THIS STEELDUCT TEST . . .

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Hand run a coupling on Steelduct uniform galvanized threads. The coupling will run free but not loose. Steelduct galvanized threads are sharp and clean because the Steelduct galvanizing process produces a measured uniform coating, free of any excess deposits of zinc. Uniform galvanized threads by STEELDUCT cut installation costs by eliminating rusty threads and assuring free running couplings.

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THE STEELDUCT COMPANY

REPUBLIC STEEL BUILDING YOUNGSTOWN, OHIO

FINAL STEP was the splicing of the 100-pair cable sections. This was the only phase of the work performed by phone personnel. About 650 pits like this were lapped to leave splicing margins. Splicing was completed by telephone personnel.

tained. Then, using an A-frame hoist, low-bed trailer and 6-wheel truck, they spotted cable reels along the route at approximate quarter-mile intervals.

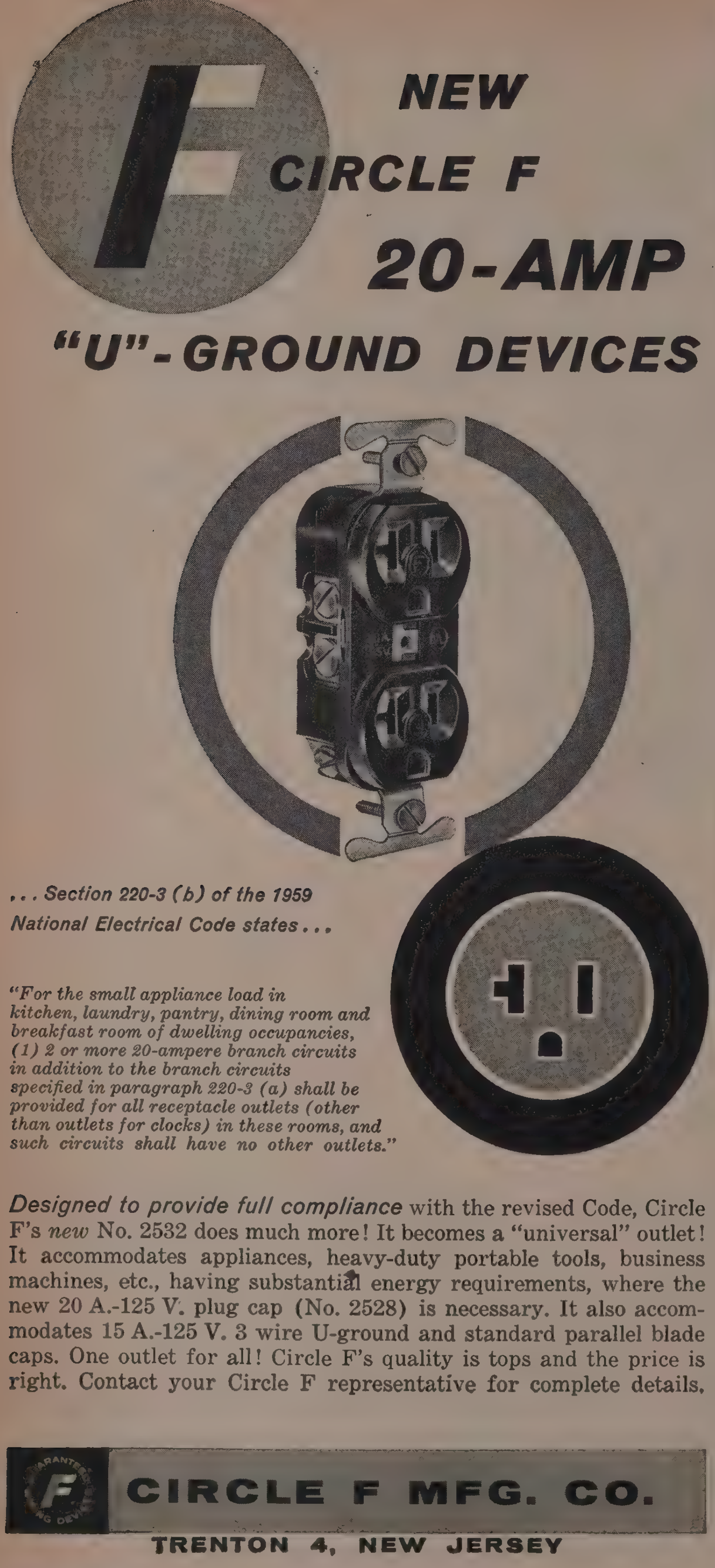
Throughout the operation, all equipment and material was moved and stored only on approved right-of-way land. And, where farmers were concerned over the possibility of importing foreign weeds or seeds, equipment was thoroughly cleaned before that owner's property was entered; a practice that paid noticeable dividends in good public relations.

In some of the more difficult rock sections, the use of the ripper was augmented by pneumatic drills, blasting and trench excavation equipment; these various methods also being adopted to establish splice pits as called for.

Where a slope was unusually steep, the auxiliary tractor was parked at the top, then the cable-laying rig was winched carefully downhill.

Toughest (and slowest) stretch in the run was laying the cable down a 480-ft 45-degree rocky drop near one of the local Exchange buildings. There the cable was encased in trench-laid asbestos-cement ducts. This tedious part of the job required a full month, indicating a daily average of only 15 ft.

Job superintendent for contractors Johnson and Degerstrom was Ed Evans, while foreman for the ductwork was Frank Borgen. Splicing of cables was completed by telephone personnel under the direction of PT&T's engineering supervisor Bruce Long. This joint venture of cable laying constituted a $90,000 contract, although the total project approximates $¾-million.



NEW CIRCLE F 20-AMP "U"-GROUND DEVICES

. . . Section 220-3 (b) of the 1959 National Electrical Code states . . .

"For the small appliance load in kitchen, laundry, pantry, dining room and breakfast room of dwelling occupancies, (1) 2 or more 20-ampere branch circuits in addition to the branch circuits specified in paragraph 220-3 (a) shall be provided for all receptacle outlets (other than outlets for clocks) in these rooms, and such circuits shall have no other outlets."

Designed to provide full compliance with the revised Code, Circle F's *new* No. 2532 does much more! It becomes a "universal" outlet! It accommodates appliances, heavy-duty portable tools, business machines, etc., having substantial energy requirements, where the new 20 A.-125 V. plug cap (No. 2528) is necessary. It also accommodates 15 A.-125 V. 3 wire U-ground and standard parallel blade caps. One outlet for all! Circle F's quality is tops and the price is right. Contact your Circle F representative for complete details.

CIRCLE F MFG. CO.
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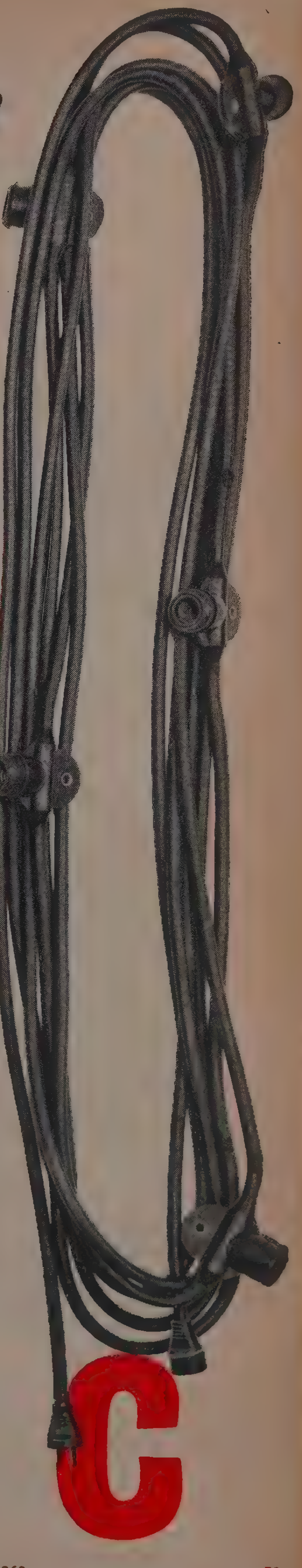

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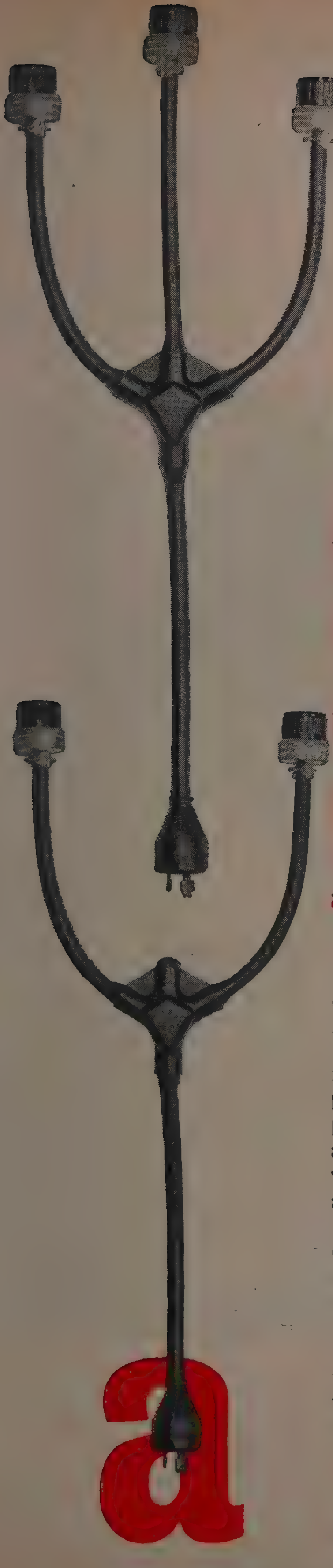
a. **CORNISH "Y" AND "W" COR-LOCK POWER JUNCTIONS** increase the number of available outlets, provide properly insulated connections and eliminate possibility of disconnection of any tool once connected. All wiring device components are UL approved. **b.** **CORNISH HEAVY DUTY EXTENSION CORD SETS, TWISTLOCK TYPE,** for positive locking of male and female components...rated at 20 amperes, 250 volts 10 amperes, 600 volts and 15 amperes, 125 volts 10 amperes, 250 volts. Components are UL approved. **c.** **CORNISH PORTABLE LITE-LINE** for wherever temporary lighting or power is needed. Molding to connectors and sockets provides full protection from rough handling and weather. Standard Lite-Line is supplied with 10 ft. spacing between sockets; has shade-holder grooves for reflectors or lamp guards. ■ All 3 available through electrical distributors from coast-to-coast.

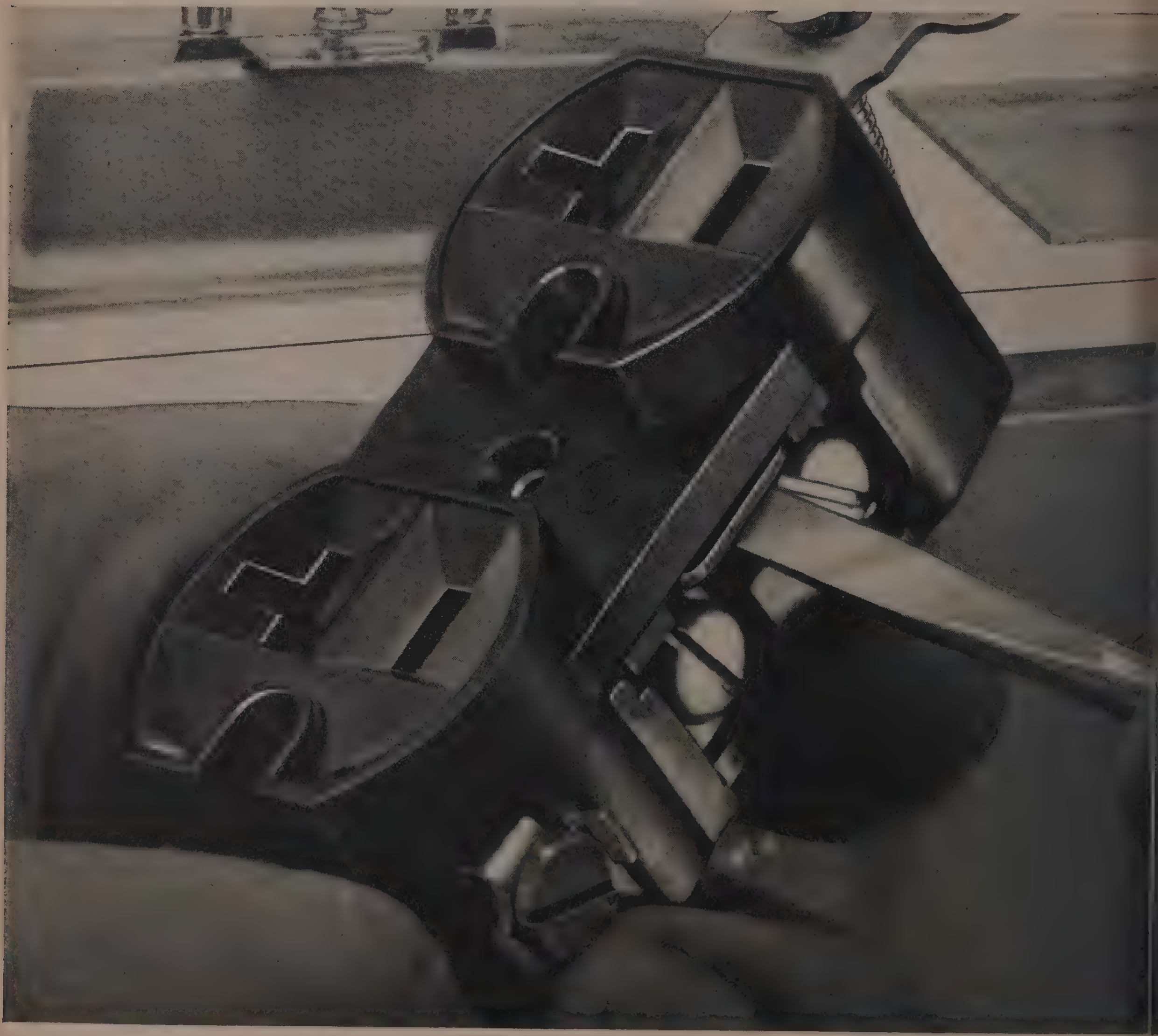


CORNISH

Cornish Wire Company, 50 Church St., New York 7, N. Y.

New General Electric outlet protects you and your customers

See how this new GE4108 De Luxe Grounding Outlet meets today's new code requirements PLUS tomorrow's needs!



1 MEETS NEW CODES FOR KITCHENS, laundries, dining rooms, offices and other areas where high-wattage 120-volt appliances may be used. You get two 20-A branch circuits from a 3-wire, 120/240V service—or from two separate 20A, 120V circuits. Just remove one or both of the breakoff links on its sides.

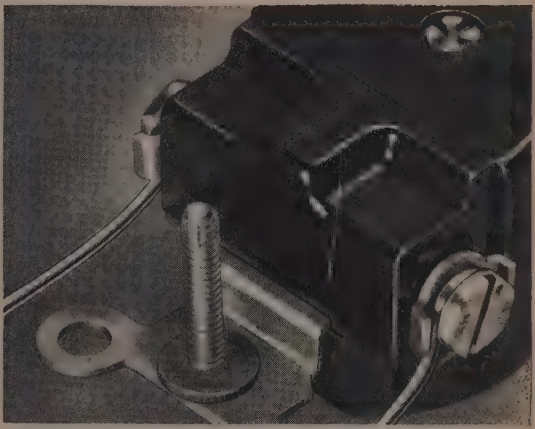
2 PLUS—FULL 20A RATING in the outlet itself—not yet required by codes. General Electric provides it so full use can be made of 20A circuits.

3 PLUS—GROUNDING for appliances, more and more of which will require it. Takes 20A and 15A grounding caps; polarized-parallel and parallel-pronged caps.

with "look-ahead features"
from electrical obsolescence

General Electric quality features give you a topnotch installation

EIGHT HOLES FOR BACK-WIRING take all the Nos. 14, 12 or 10 Awg wires you need, "in" and "out" for through wiring—in tight, pressure-clamp connections. You can "loop" wires under screws on the sides.



TWO GREEN GROUNDING SCREWS make it more convenient for you to carry through grounding wires —take straight ends or loops. When all terminals are used, this outlet will take 10 wires!

STURDY CONSTRUCTION, with double-wipe contacts; "through" strap; captive mounting screws. No. GE4108; brown or ivory; 20A, 125V, U.L.—listed, meets Federal and REA specifications.

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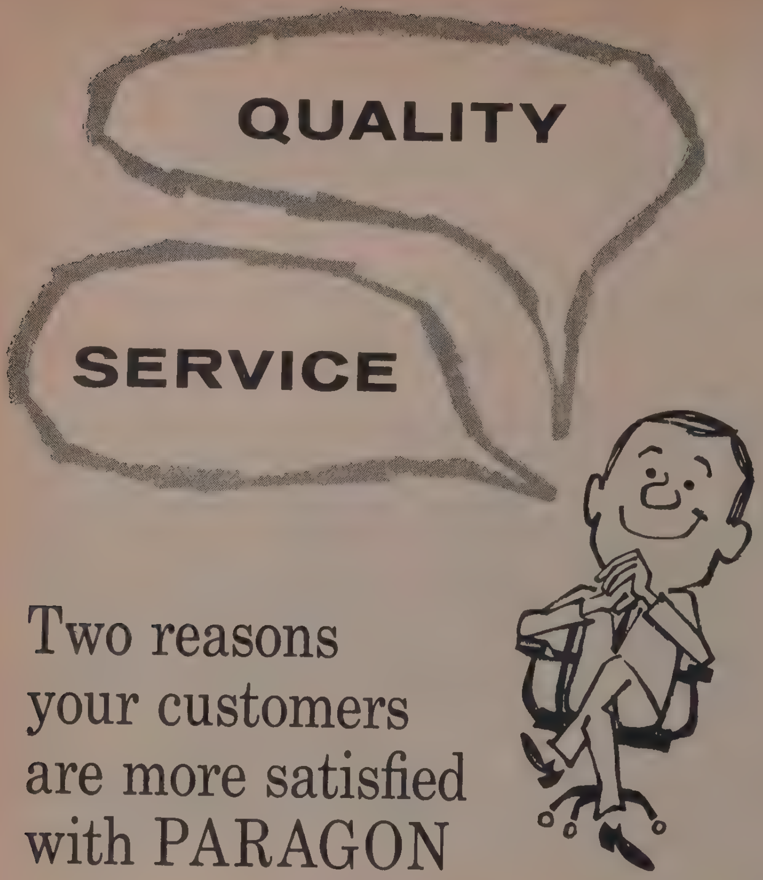
Ask your General Electric distributor to show you the whole line of high-quality G-E devices — engineered to meet today's codes *plus* tomorrow's needs! General Electric Company, Wiring Device Department, Providence 7, Rhode Island.

MEDALLION HOME
LIVE BETTER ELECTRICALLY

KEEP PACE ELECTRICALLY

Progress Is Our Most Important Product

GENERAL ELECTRIC



Two reasons your customers are more satisfied with PARAGON

Install Paragon on your next timer job. Get the double dependability of Paragon quality, backed by a service policy second to none.

FIRST IN QUALITY — Paragon time switches and timers are produced with all the precision and accuracy of a fine watch. Numerous quality-control inspections and meticulous testing maintain the highest standards for trouble-free operation. Easy installation, heavy-duty, long-life motors and easy-to-read dials are a few reasons more electrical contractors install Paragon timing devices.

FIRST IN SERVICE — Paragon maintains a network of 88 service centers strategically located throughout the country. Each of these centers carries a complete stock of factory-tested parts. If a Paragon timer ever needs repairs, the service center nearest you can handle the job quickly, efficiently and economically. In-warranty repairs cost your customers nothing . . . and only a nominal charge is made for out-of-warranty work. That's a service policy hard to beat anywhere.

PARAGON
ELECTRIC COMPANY
1614 Twelfth Street, Two Rivers, Wisconsin

MEMBER NASA

TIME IS MONEY — CONTROL IT WITH PARAGON

ESTIMATING FORUM—VII

[FROM PAGE 70]

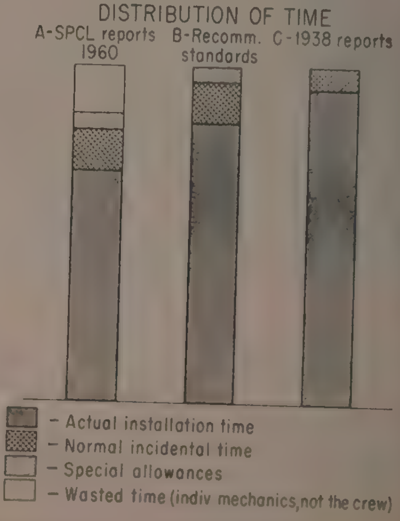
importance of incidental labor to the estimator and job superintendent. In each, Column A represents conditions reported on some current (1960) projects; B shows suggested standards; C represents conditions reported on some 1938 projects. The time figures depict the effects of mechanics' attitudes and not the effects of their natural ability to produce.

Table I shows variations in workday practices with a detailed breakdown of items constituting total incidental time during an 8-hour day. Use Column B (suggested standard) as a benchmark. The 80 minutes (1⅓ hours) per day for incidental time has been endorsed by many contractors as quite reasonable. This does not include such special incidental labor as study time, handling of heavy tools, etc.

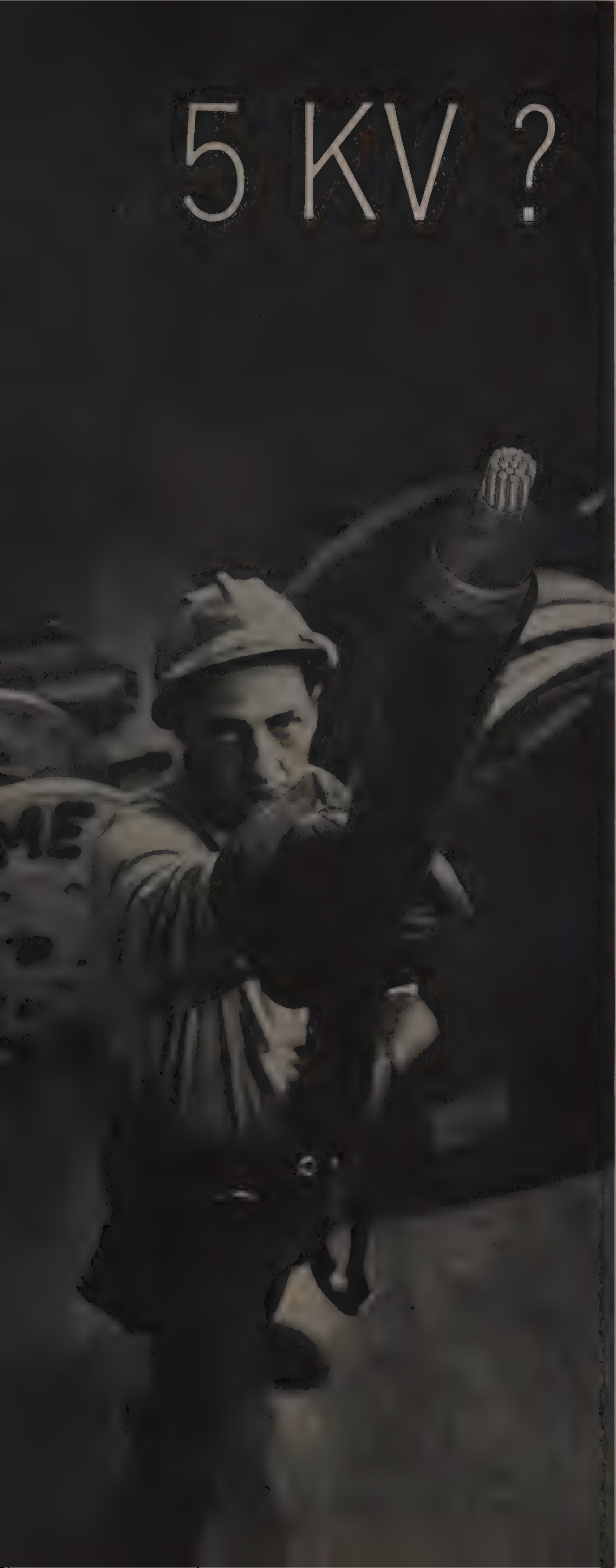
The morning and afternoon "coffee break" item (10 minutes each) may cause some raised eyebrows. This has become an accepted practice in office and industrial establishments and electricians feel that they are as much entitled to it as men in other endeavors.

Now, compare the 80 minutes of Column B with the 150 minutes of Column A (some 1960 projects). These current jobs show an added one hour and ten minutes per man per day for incidental time. Here the mechanics insisted on being paid for changing their clothes, prolonged relief periods, and then waste ten minutes or more waiting for quitting time.

Next, note the 30-minute total incidental time in Column C (1938



5 KV ? 15 KV ?



HIGH-VOLTAGE CABLES—IN THE LENGTH YOU NEED—NOW AVAILABLE "OFF THE SHELF"

More and more contractors are being invited to bid on projects which include high-voltage cable.

Now *you* can go after this profitable business, because Rome has made it possible for you to:

1. Get the cable you need, *when* you need it, in the *length* you need.
2. Get cable of the *quality* the job requires. (In high-voltage work, "second best" cables can eat up your profits during call-back after call-back.)

Today you can order the length of high-voltage cable you need—ten feet or ten thousand—right "off the shelf," through Rome's new stockpiling program.

And you'll get the quality your customers expect—the same Rome cables that have earned their reputation the hard way: through miles upon miles of high-voltage jobs over the years.

Popular sizes 5 and 15 kv Rozone Roprene single-conductor cables are currently being stocked at Rome in the sizes most frequently needed.

This gives you a quick answer to a wide variety of cable problems. Rozone is a versatile, long-life insulation that resists ozone and moisture. Roprene is tough neoprene jacketing that resists weather, fire, oils, chemicals, heat and aging.

Start on your next job Your next bid may be on a school, commercial building, or industrial plant which requires high-voltage cable. Be ready for this business. Your Rome distributor is the man to call for 5 and 15 kv cable. Ask him about it this week.

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ROME CABLE
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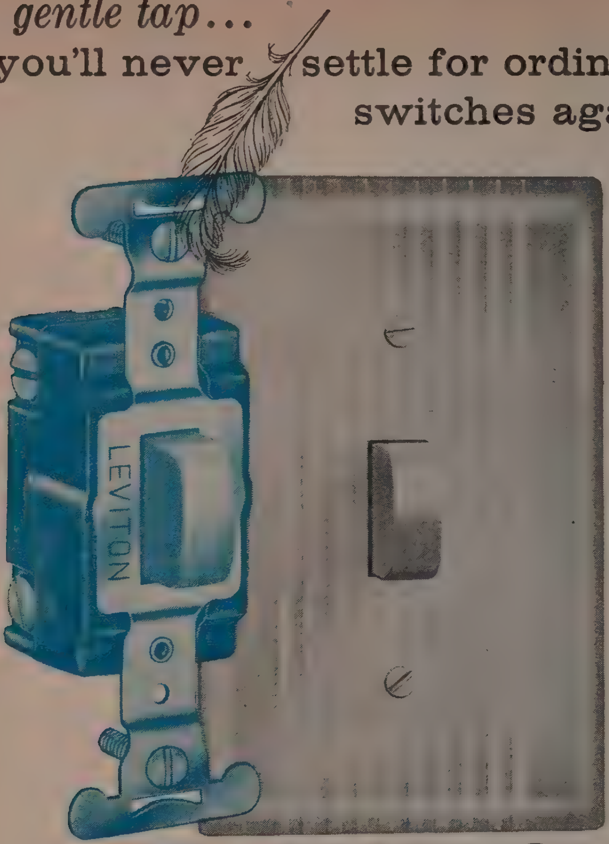
a gentle tap...
and you'll never settle for ordinary switches again!



LEVITON A.C.
TOUCH SWITCH

Installs in any position...small enough to fit any gem box and standard wall plate ...and notice that quiet, "love tap" operation! Leviton's new 15A—120-277V. AC Touch Switch is a natural for homes, schools, apartments, office buildings, hospitals, industrial plants... anywhere! Tap it from any position, any angle!

CHECK THESE SPECIAL FEATURES:

SAFE OPERATION—install vertically, horizontally or upside down, yet a gentle tap gives positive, non-stalling action. Can't hang up...in any position. Special heavy silver contact points increase safety margin, prolong service life.

EASY INSTALLATION—side wired for convenience. Only 1" in depth. Large head brass terminal screws, backed out and staked, accommodate up to No. 10 conductors. Mounting screws are locked in straps ready-to-install. Interchangeable with any standard switch and wall plate.

HIGH CAPACITY—will accommodate high inductive loads of fluorescent systems, or full rated capacity of incandescent filament lamp loads. Take full load currents up to 80% of the switch rating for motor control.

RUGGED CONSTRUCTION—simplified construction and advanced design assure maximum efficiency, long life under heavy duty use . Heavy gauge steel plaster ear straps are riveted to housing for permanent assembly.

Creatively engineered and subjected to exhaustive "in-use" tests, Leviton AC Quiet Switches have proven themselves ideal for the new 4-wire electrical systems requiring switches rated at 277 volts. Available with brown or ivory button.

Listed by Underwriters' Laboratories, Inc. For complete details write to:

Your best jobs are done with... LEVITON

Leviton Manufacturing Co Brooklyn 22, New York • Chicago • Los Angeles • Leviton (Canada) Ltd., Montreal.
For your wire needs, contact our subsidiary AMERICAN INSULATED WIRE CORP. Pawtucket, R. I.

projects). This is almost an hour less than the recommended standard (B) and two hours less than the 1960 reported projects (A). While this limited time may seem radical, such conditions were common among all building trades from 1931 through 1938 when work was hard to come by. Men were glad to be working and were willing to give a large percentage of the day to actual installation work.

Table II represents another way of looking at the 8-hour day with a breakdown of four categories including actual installation time. It has the advantage of emphasizing the "wasted time" item in Column A. The bar-chart is a graphic presentation of the Table II listing. All illustrations emphasize the impact of mechanics' attitudes on the proportion of each day actually devoted to installation work.

Better Office Support. In normal times, contractors think they support their field men well. When times get slow or dull, they find that they can do much better. Job visits are more frequent, working drawings are more complete, and material deliveries are followed more closely. Improved office supervision boosts over-all job efficiency and saves the job foreman's time. Through personal contact, he gets pertinent information more quickly, solves problems on the spot and spends less time tracing materials.

Other Trades. During slow times, other trades experience the same general upgrading of productivity as the electricians. They too have their better men on the job, work is stepped up, and more cooperative attitudes benefit all concerned.

How Much Reduction? At this point, a logical question might be: How much can a contractor reduce his labor units during such periods? To answer that, one would have to know just what is represented by the individual's "standard unit"; what type of crew is to be used; the nature of the work; and many other pertinent things. To get some idea, we can use some general figures.

Let's assume that we have three periods in the construction cycle: boom, average and low. Call the average 100%. Studies show that in boom times the average labor cost unit must be boosted 10% to 15%. In dull times it can be lowered about 15%. That gives about a 30% range between the two periods. War time periods, however, run exceptionally high.

New Skil Roto-Hammer—lowest cost way to drill masonry holes! Compare:

ACTUAL DRILLING TEST Based on 1000 holes (¾" x 4" deep) in masonry—labor at $3.00 per hr.	**SKIL NO. 726 ROTO-HAMMER**	1 Carbide Bit required*	19.38 hours of labor	$80.14 (labor plus bit)	Cost: 8¢ per hole
	ORDINARY HAMMER	24 Star Drills needed	100.4 hours of labor	$337.20 (labor plus bit)	Cost: 34¢ per hole

*New Skil carbide bits stay sharp 20 to 30 times longer than star drills.

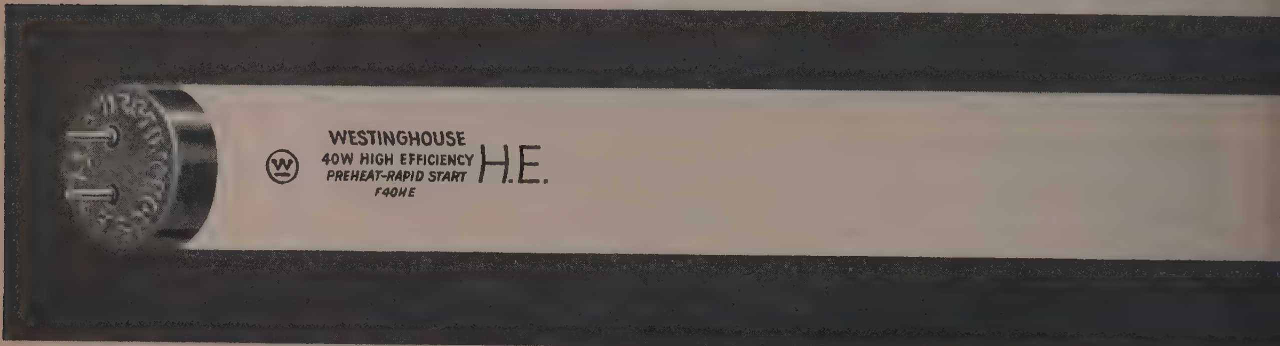
The SKIL Roto-Hammer is not only the fastest way to drill holes, but easiest too. Automatic power rotation eliminates tiresome hand turning of star drills.

Ask your Skil distributor for demonstration, today. Look under "Tools—Electric" in the Yellow Pages. Or write Skil Corporation, Dept. 130M, 5033 Elston Avenue, Chicago 30, Illinois. In Canada: Skiltools Limited, Trenton, Ontario.

No springs to break. Electro pneumatic drive eliminates springs for lowest maintenance cost. Model 726 (½"-1"); Model 736 (1"-2").

SKIL ... AND SKILSAW POWER TOOLS

NE



Westinghouse HIGH
the brightest 40-watt
lamps you

- **3200 lumens output for 40-watt lamps**
- **6400 lumens output for 96" Slimline lamps**
- **No premium cost**
- **No extra cost for power**
- **Just snap into your present fixtures**

W!

EFFICIENCY Lamps... and slimline fluorescent can buy

Now you can increase the lighting level in your factory, office, warehouse or store without changing a single fixture, without adding to power costs and without paying a premium price for the lamps.

These new High Efficiency Westinghouse Fluorescent Lamps (40-watt Universal and 96" Slimline types) give 15% more light than the cool white and 36% more light than the daylight lamps you now use. They maintain highest levels of light over their long life.

Try High Efficiency Lamps in an entire work area. If you don't agree that you get more light—softer, more comfortable light—we will exchange them for any Westinghouse fluorescent lamps of your choice.

Order new "H.E." lamps today from your authorized Westinghouse Lamp Agent or nearest Westinghouse Lamp Sales Office. You can be sure . . . if it's Westinghouse.

Westinghouse

WESTINGHOUSE LAMP DIVISION
Westinghouse Electric Corporation, Bloomfield, N. J.

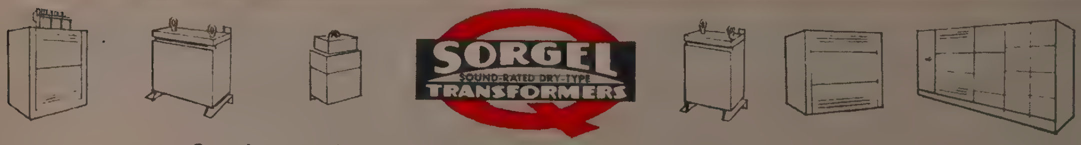
SORGEL'S SPECIALIZATION

assures Quiet Quality dry-type transformer performance that's the finest in the industry

Since 1916 the principal products at Sorgel Electric Company have been dry-type transformers. Because of this long-time pioneering, specialization and experienced engineering, Sorgel customers are assured of continuous, more dependable transformer performance.

The Quiet Quality of Sorgel dry-type transformers provide the highest efficiency, which reduces operating costs. Sorgel specialization assures a product that requires little or no maintenance, and a design that's easy, more economical to install.

Imaginative progress has been, and is being, made every day at Sorgel. In all forms of modern electrical distribution the Sorgel product is your best buy in stepping down higher distribution voltage to utilization voltage for institutional, commercial and industrial buildings. Look for the Sorgel mark, and when you find it, you'll know this electrical installation was the first choice of a quality-conscious Consulting Engineer, Plant Engineer, Contractor or End-user who wanted to assure dependable, uninterrupted electrical distribution.



Complete Line for Every Purpose up to 10,000 Kva, up to 15,000 Volts, Including Special Transformers and Saturable Reactors

SORGEL ELECTRIC COMPANY

836 West National Ave., Milwaukee 4, Wisconsin

Sales engineers in principal cities. Consult the classified section of your telephone directory or communicate with our factory.

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NEW PRODUCTS
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Use first line of boxes. Insert item numbers of products on which more information is desired.

CATALOGS, BULLETINS AND ENGINEERING DATA:

Use second line of boxes. Insert item numbers of literature desired.

ADVERTISEMENTS:

Use third line of boxes. Insert page numbers of advertisements on which additional information is desired. Where more than one advertisement appears on the page, include the manufacturer's initials.

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- PLEASE PRINT LEGIBLY
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- DO NOT USE PENCIL OR RUBBER STAMP

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NEW PRODUCTS
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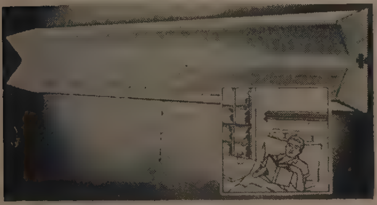
Power Switching Center (1)

New standardized switching centers are coordinated combinations of load interrupter switches, operating mechanisms and fuses in metal housings under a single assembly rating. Eight voltage ratings are available from 2.4 to 14.4 kv. Each assembly is rated for maximum continuous current and for symmetrical MVA and asymmetrical amperes on system short circuit. Switch will close safely and operating mechanism will hold on fault current. Either boric acid or current limiting fuses are available. Fuse compartment is accessible from the front through a door-key interlocked with switch operating mechanism. Standardized bays or cubicles are available in a large variety of arrangements for entrance, feeder or auxiliary application and are readily assembled into power switching centers. Manual operating mechanism is of the stored energy type and switch operation is independent of the speed with which the handle is moved. Pneumatic operators are available for remote or automatic operation.

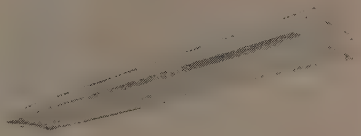
I-T-E Circuit Breaker Co., Greensburg, Pa.



Fluorescent Fixture (2)

A new fluorescent fixture adapted to a wide variety of special, wall mounting lighting applications. It makes use of two lighting components, up and down, either independently or jointly depending upon the lighting needs of location where it is mounted. Fixture is called Multi-Purpose Wall light. It makes three distinct types of lighting available from a single unit. When both downward and upward components are used, a desirable balance of general illumination with direct reading or work light is obtained. Up light provides general room lighting, downlight only permits reading, working, etc., without lighting an entire room. Fixture is made in 2-, 3- and 4-ft lengths. Catalog is available.

Miller Company, Meriden, Conn.



Lighting Fixture (3)

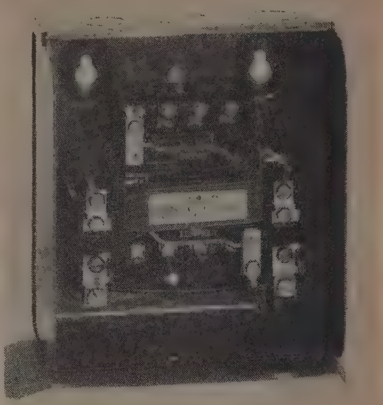
A new 4-lamp commercial unit, called "Fairview-IV," has one-piece Cleartex enclosure. It measures 14 in. in width. The 4-ft units accommodate four rapid-start lamps and can also be obtained for two, three rapid-start lamps. The 8-ft unit is available in tandem rapid-start or 8-ft slimline, 2, 3 or 4 lamps wide. The surface mounted Fairview-IV measures 4⅜-in. deep. Fixture can also be suspended when used with A-J adjustable hangers.

Day-Brite Lighting, Inc., 6260 *N. Broadway, St. Louis* 15, *Mo.*

Cable (4)

A new small-diameter plastic control cable known as Okonite P-30, is a general purpose control cable for utilities and industries suitable for all types of installations—conduit, aerial, duct, tray, direct burial, in wet or dry locations. Multi-wall construction offers three-fold electrical protection. Double wall of mechanical protection against chemical attacks of oils, acids, alkalies and other materials plus tough physical and flame-resistance qualities of Okoseal outer jacket makes cable ideal for use under rigorous operating conditions. Recommended particularly for dc circuits in wet locations and for temperature ranges to 75C.

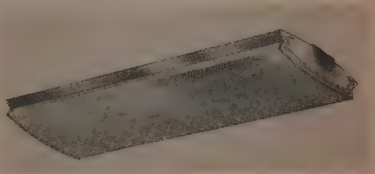
The Okonite Company, Passaic, N. J.



Motor Starters (5)

Size 00 magnetic contactors and starters for low-hp light duty applications have been added to the G-E 100 line of motor starters. Designed specifically for controlling conveyors, small pumps and fans, they incorporate all the features of the 100 line. Vertically slanted contacts, with horizontal action, reduce contact contaminations from dirt and dust. The "start wire" in the strong-box coil is Mylar insulated. Available for either 115 or 230 volts, the 00 starters and contacts are single, 2- or 3-phase with ratings from ⅓ to 2 hp.

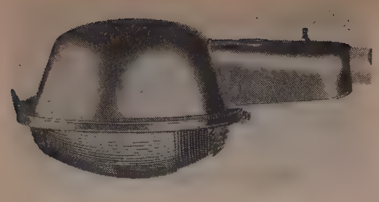
General Electric Co., Schenectady 5, *N. Y.*



Luminaire (6)

New motif wraparound luminaire is fully enclosed and shielded by an especially developed refractor-diffuser lens. Unit is shallow having an apparent depth of 2⅛ in. when viewed from the side. Refractor-diffuser is made of color stabilized polystyrene. Wireway cover is removable. Knockouts provided for surface, suspension or end-to-end installation. Available for 2- and 4-lamp rapid start operation. Luminaire channel is grooved to accommodate sliding clamp type hangers.

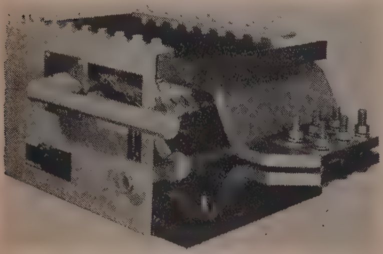
Mitchell Lighting Div., Compco Corp., 1800 *N. Spaulding Ave., Chicago* 47, *Ill.*



Luminaire **(7)**

New 2500 Series "Urbanoval" end-mounting street lighting luminaire for residential areas or secondary streets where uniform, low-level lighting is desired. It is designed for 100-, 175- or 250-watt mercury lamps or incandescent lamps up to 4,000 lumens. A choice of two Revere-Corning Pyrex refractors provides ASA-IES Type II or Type II 4-way distribution patterns with clear lamps, or Type III or 4-way distribution with phosphor-coated mercury lamps. Unit is available with choice of 1¼ in. or 2 in. slipfitter. Bulletin is available.

Revere Electric Mfg. Co., 7420 *Lehigh Ave., Chicago* 48, *Ill.*



Disconnect Switch **(8)**

A new low-voltage high-current disconnect switch for steel mill and heavy industrial use. Suitable for 750-volt operation, the copper "Wedge" type switch is available in a standard 5000-amp unit or in multiples of 5000 amps for use in gang-operated applications. Both single-throw and double-throw designs are offered. Some of the design features include self aligning hard-drawn copper contact wedges; positive non-fatiguing back-up springs; silvered contact surfaces; locking type operating handle; and copper cross-section.

Delta-Star Electric Div., H. K. Porter Company, Inc., 2437 *Fulton St., Chicago* 12, *Ill.*

Load Center **(9)**

A new duplex circuit breaker load center is designed for back-to-back assembly in a circuit breaker case of standard size. The breaker mechanism is mechanically attached to a rigid steel back plate. Duplex circuit breakers are available in the following ratings: 15A-15A; 15A-20A; and 20A-20A at 120/240 volts ac. Single circuit breakers of the same electromechanical design are available in 15, 20 and 30 amps at 120/240 volts ac ratings. Load center panel boxes are available in 2 through 42 circuit sizes in various types. Dimensions of smallest box are: $5\frac{1}{16}$ in. wide, $7\frac{1}{16}$ in. high, and $2\frac{17}{32}$ in. deep. For the largest box, $15\frac{5}{16}$ in. wide, $49\frac{21}{32}$ in. high and $5\frac{5}{32}$ in. deep.

Bryant Electric Co., Bridgeport 2, *Conn.*

Electrical Tape **(10)**

A new cold-weather vinyl electrical tape is called Slipknot "CW." The working range is from 20° below zero to 120° above. Slipknot CW vinyl electrical tape is 8½ mils thick and it is marketed only in 66-ft rolls at present.

Plymouth Rubber Company, Inc., Canton, Mass.

Batteries **(11)**

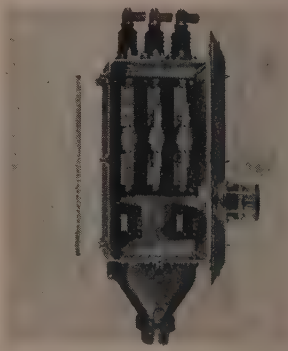
Nickel-cadmium batteries have been added to this line of industrial storage batteries. The batteries, having nickel- and cadmium-oxide active materials contained in perforated steel pockets of positive and negative plates, are offered for use in a number of specialized applications. It can be used in starting engines to generate emergency power; emergency lighting systems; switchgear tripping in electric utility substations; standby to assure continuous operation of microwave systems; emergency communications and safety equipment in marine service. The line is available in 22 electrical sizes, with 8-hr capacity ratings ranging from 10 to 450 amp-hrs, and in other special types and sizes.

Exide Industrial Division, Electric Storage Battery Company, Rising Sun and Adams Aves., Philadelphia 20, *Pa.*

Enclosures **(12)**

New submersible metalclad enclosures for power fuses, rated 13.8 kv and 95 kv BIL, are available off-the-shelf in two basic designs. One design has a hinge-type door and accommodates solid-material boric-acid power fuse Type SM-5C. These fuses have interrupting capacity of 500 mva, symmetrical, at 13.8 kv and a continuous rating of 400 amps. The second design, intended for confined areas, mainly underground vaults, has a suspended-type door. It accommodates solid-material boric-acid power fuses Types SM-4B and SM-5B. Both enclosures are designed for indoor and outdoor installation on utility systems as well as in industrial and commercial buildings. They are wall-mounted and have compartmented phases.

S&C Electric Co., 4435 *North Ravenswood, Chicago* 40, *Ill.*



Current Limiting Units **(13)**

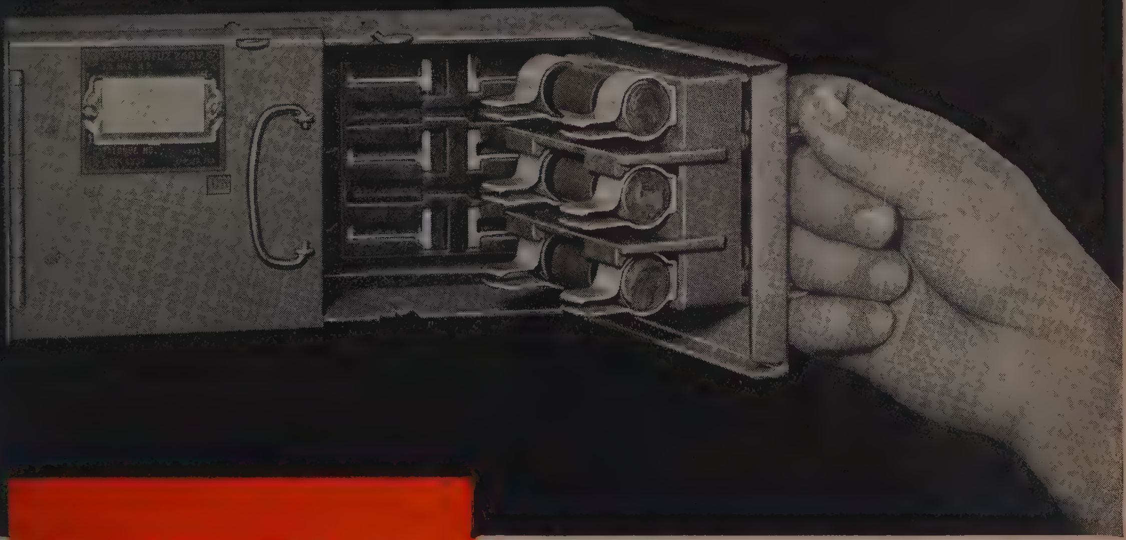
Current limiting protection against high-value short-circuits, and provision for current metering on power circuits of 800-amp, 600-volt, now available in weatherproof construction. Similar current limiting units, with and without aerial lugs or metering for 240- and 600-volt distribution systems to 2,000 amps, afford protection to 100,000 rms amps. Wiping sleeves, stuffing boxes, or conduit entrances can also be provided.

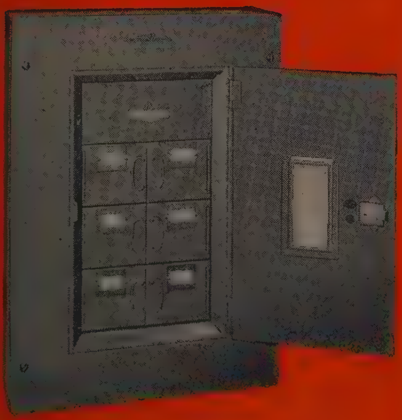
Hope Electrical Products Co., 24 *Long Ave., Hillside, N. J.*

NEW! TWIN UNITS FOR 19″ WIDE BOXES

FRANK ADAM...

HINGED COVER SWITCHES





ONE-PIECE STEEL ENCLOSURES

Furnished with doors as standard.
Flush or surface mounting.
Available in 4¾″ or 6″ depths.
Extra wide wiring gutters.
Silver-plated connections throughout.
100 to 400 amp. mains.

TYPE KSF–KLAMPSWITCHFUZ

(Clamp-Switch-Fuse)

Now—twin hinged-cover 30/30 or 60/60 amp. switches for 19″ wide enclosures! Formerly available only in 24″ and 33″ wide boxes, the new smaller size saves both space and money.

Now—only 4½″ high instead of former 6″ height. Permits almost 25% increase in number of circuits in any box, or reduces the size of enclosure needed.

KSF Switches are ideal for installation where the more expensive handle-operated quick-make, quick-break switches are not required.

KSF Switches have increased horsepower rating—are furnished for plug-in or bolt-on connections for quick, easy circuit changes. All contacts are heavily silver-plated. Padlock device on all switches.

Your FA distributor has them in stock

THE PRODUCERS COUNCIL
AFFILIATED WITH THE AMERICAN INSTITUTE OF ARCHITECTS

See our catalog in SWEET'S

KEEP PACE ELECTRICALLY

FRANK ADAM ELECTRIC COMPANY SINCE 1891
P. O. BOX 357, MAIN P. O. • ST. LOUIS 66, MO.

busduct • panelboards • switchboards • service equipment
safety switches • load centers • Quikheter

ANNOUNCING . . . the

LIGHTEST

and most powerful
4" segment bender
on the market

Greenlee No. 777
(1-1/4" thru 4")
weighs only 65 lbs.
(exclusive of shoes)

COMPARE THESE IMPORTANT ADVANTAGES . . .

FEWER PARTS

one-piece frame of high-strength aluminum
one set of aluminum pipe supports for all pipe sizes
one set of safe, quick-locking pipe support pins.

THREE BENDERS IN ONE

a few optional parts adapt the No. 777 segment bender to fast, one-shot 90° bending 1/2″ thru 2″ and thin-wall bending 3/4″ thru 2″.

SAFE, ONE-MAN OPERATION

safety valve in pump, oil by-pass in ram, weighs only 65 lbs. excluding bending shoes.

Unmatched for over-all performance, the new Greenlee No. 777 does more jobs for you than any other bender of its type. Use it to make offsets . . . large sweeps . . . concentric bends . . . one-shot 90° bends . . . thin-wall bends.

Its 27-ton ram has power to spare for segment bending of steel or aluminum conduit and pipe 1-1/4″ thru 4″ — will bend extra heavy schedule 80 pipe. Comes equipped with a hand hydraulic pump, but can be operated with power pump for even faster performance.

OPTIONAL EQUIPMENT FOR ONE-SHOT AND THIN-WALL BENDING

One shot 90° bending 1/2″ thru 2″

90° bends in one shot An important *exclusive* advantage you get with this new, lightweight GREENLEE segment bender. Simply by adding bending shoes and adapter, you can make any bend up to 90° in 1/2″ thru 2″ conduit or pipe in *one shot!*

Thin-wall bending 3/4″ thru 2″

Quickly mounted thin-wall attachment The No. 777 segment bender can be quickly and economically converted to bend thin-wall conduit 3/4″ thru 2″. Standard No. 770 thin-wall attachments fit the No. 777 bender with only the addition of one roller.

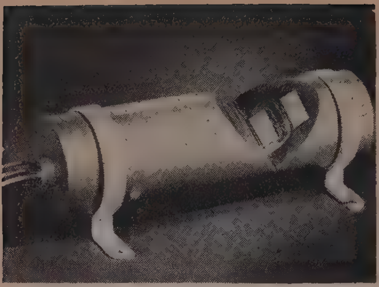
ASK YOUR DISTRIBUTOR FOR A DEMONSTRATION NOW! Write for bulletin E-249

GREENLEE TOOL CO., 1937 Columbia Ave., Rockford, Illinois

TOOLS FOR CRAFTSMEN
GREENLEE ®

JOB-PROFIT TOOLING

. . . cost control for contractors



Fluorescent Ballast (14)

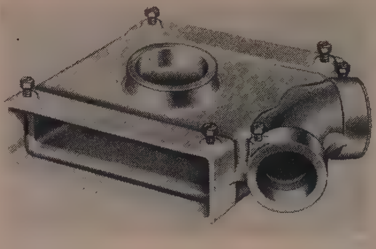
A line of totally weatherproof fluorescent ballasts in a new, cylindrical shape features core, coil and capacitor encapsulated in a special compound which also serves as ballast case. The compound seals internal components, forms corrosion-proof enclosure, eliminates conventional metal case and seam. Ballasts are supplied with standard pipe-threaded-nipple and movable zinc-plated steel mounting brackets; can be operated submerged if water-tight junction boxes are used. Designed for proper lamp starting in temperatures as low as —20° F, ballasts meet all UL requirements and will replace every model in G-E's conventional line of steel-case weatherproof ballasts.

General Electric Company, Schenectady 5, N. Y.

Floodlights (15)

New wide-beam mercury-vapor floodlights, called Spreadliter, have been introduced. They feature uniform distribution; full 18-in. parabolic Anadol aluminum reflectors; fin-cooled aluminum socket housing; universal adjustment; easy servicing. Combination pole-top floodlights with ballast are available as a complete package. Spreadliters for remote ballast mounting are also available in wall, crossarm, pipe clamp and pole top type. Color corrected 1000-watt lamp Spreadliters with ribbed lens project spreads of 164° horizontal, 120° vertical. Clear lens types have a 96° circular beam pattern. 400-watt units with ribbed lens have beam spreads of 163° horizontal, 101° vertical. Bulletin is available.

Steber Division, Pyle-National Company, 1334 *North Kostner Ave., Chicago* 51, *Ill.*



Adapter (16)

Simplified wiring take-offs in underfloor raceway systems have been accomplished by a Duct-to-Conduit adapter which provides lateral take-offs to conduits at 45-degree angles. Grey iron casting adapters have two large conduit openings, 1¼-in. size, each at 45-degree angle to raceway, permitting entrance of two conduits to duct or two separate feeds from duct to independent units. Adapter, available for both No. 3 and No. 6 sizes of Wheatlanduct, may be installed anywhere along a duct run. They are also used to side-feed the underfloor raceways from switch or panel wall boxes and to feed duct runs from boxes located on columns. Adapters may be used to feed isolated runs of duct or for conduit feed to isolated floor boxes.

Wheatland Electric Products Co., 500 *Logan St., Carnegie, Pa.*

Transformer (17)

A new epoxy-porcelain window-type heavy-duty high-current metering transformer, Type BKAW-M, has been introduced. Available in 5-kva, 8-7 kv and 15-kv insulation classes in current ratings 1000 through 4000 amps, the transformer combines the characteristics of epoxy-resin and creep-flashover characteristics of porcelain. Toroidal windings on a continuously wound core are encapsulated in epoxy resin which serves as insulation, support and case for transformer element. Porcelain sleeve provides insulation for primary conductor. Transformer can be installed in any position. It is impervious to acid and salt atmospheres.

Allis-Chalmers Manufacturing Co., Milwaukee 1, *Wis.*

Cartridge Fuses (18)

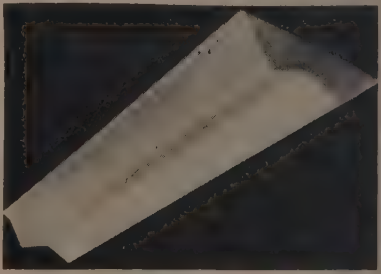
A complete line of dual element cartridge fuses, called "Fuseking," in 250-volt and 600-volt range is now available. The snap-open jaws of the heat sinks are activated when heat from any source approaches 300°F. Thermal cut-out element provides time-delay performance. Fuse link elements are ruggedly constructed. It is listed by UL. Technical Bulletin Form No. 500 is available.

Monarch Electric Division, El-Tronics, Inc., Jamestown, N. Y.

Pushbutton Stations (19)

A complete line of "Merc-Amatic" mercury pushbutton stations is now offered including multi-unit combinations with indicating light assemblies for panelboard as well as individual station installations. All of these mercury actuated switch devices employ newly designed high current-interrupting capacity sealed mercury contactors with capacities up to 50 amps. They are dust, dirt and moisture-proof. Many models are designed for outdoor weatherproof service. Bulletin No. 800 is available.

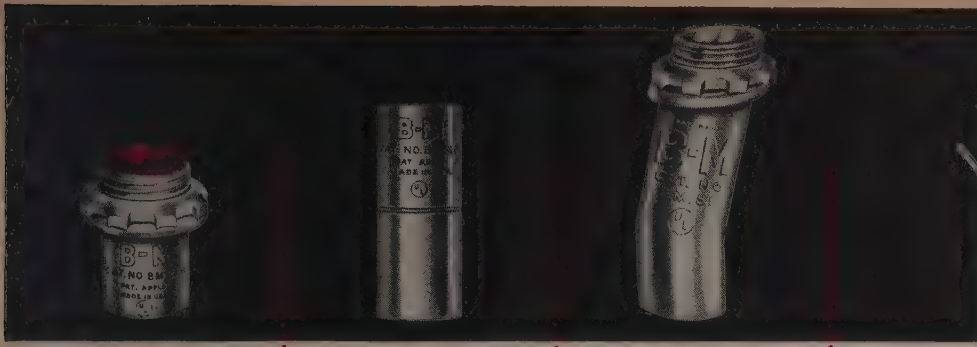
Tigerman Engineering Co., 4332 *N. Western Ave., Chicago* 18, *Ill.*



Fluorescent Fixture (20)

A new fluorescent fixture with a one-piece polystyrene diffuser and mounting two 40-watt rapid start lamps, provides glareless illumination. Seamless sealed construction eliminates collection of dust and dirt. Diffuser is hinged from either side. Overall size is 3½ in. deep by 12 in. wide by 4 ft long.

Modern Light Company of St. Louis, 7809 *Maplewood Industrial Ct., St. Louis* 17, *Mo.*



Red Throat
BM-21B
½″ Connector
BM-22B
¾″ Connector
BM-23B
1″ Connector

BM-41
½″ Coupling
BM-42
¾″ Coupling
BM-43
1″ Coupling

BM-51
½″ Offset Connector
BM-52
¾″ Offset Connector

BM Offset
Connectors
showing how
wires are
guided over
box edge.

FOR MORE PROFITS

Save time and money with

B-M ORIGINAL INDENTER FITTINGS

Here is the combination that is unbeatable when it comes to easier E.M.T. installation at less cost. New lightweight plier size indenters make setting up thin wall conduit a breeze. B-M fittings are neater too! No unsightly nuts or projecting set screws.

A few more of the plus features of B-M fittings are Concrete tight—Vibration resistant—Extra heavy bright zinc plate, salt spray and acid drip tested for corrosion resistance—Extra heavy positive bonding locknuts—smooth rounded edges or bushed throat type connectors that prevent insulation damage—All steel construction with extra heavy gauge wall thickness.

ALL BRIEGEL FITTINGS ARE U. L. APPROVED AS CONCRETE-TIGHT

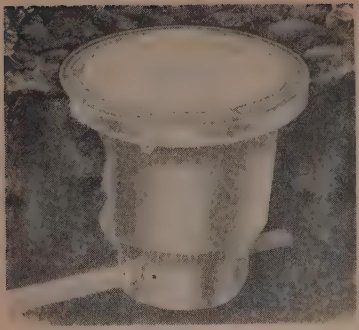
When setting E.M.T. in concrete you can make each job easier and more profitable by using Briegel All Steel Indenter Fittings that have UL approval as Concrete-Tight. Contractors everywhere recognize their cost cutting qualities and the fact that they make each wiring job a better job. It is only natural that Briegel Fittings are the most widely used E.M.T. connectors and couplings.

BM PLIER SIZE INDENTERS
BM—No. 607 ½″
BM—No. 608 ¾″
BM—No. 609 1″

All B-M indenter type fittings far exceed the requirements of U. L. file card E 10863 and Federal Specifications W-F-406.

BRIEGEL METHOD TOOL CO.
GALVA • ILLINOIS

USED THE MOST FROM COAST TO COAST



Fixture (21)

A new weatherproof fixture for flush installation in earth, concrete or plaster, is designed for outdoor installation in gardens, around commercial buildings, etc. All-cast aluminum construction assures maximum corrosion resistance, and unit is sealed to meet all weather and grade conditions. Unit is designed for 150-watt, PAR 38 flood or spot lamp, sealed beneath a clear-crystal tempered lens. Internal adjustment permits aiming of lamp in any direction up to 30° off the vertical. Standard unit measures 9 by 9 in. and is tapped for ½ in. conduit side entry. Catalog No. 5100 is available.

Prescolite Manufacturing Corp., 2229 *Fourth St., Berkley, Calif.*

Cover Plate (22)

A new tamperproof snap-cover protects outdoor receptacles and switches against moisture, rain, snow and ice, and also protects against vandalism, current pilfering and accidental shock. A built-in hasp permits use of a padlock on the Saf-T-Lok weatherproof device. A single deep snap-cover allows use of two large plug caps side by side, in any of 14 different 1-, 2- and 3-gang combinations. It is designed for vertical mounting.

Bell Electric Co., 5735 *S. Claremont Ave., Chicago* 36, *Ill.*

Overload Relay (23)

A compact overload relay that compensates for both heat and cold, operating on the same time curve at all temperatures from minus 20°F to 165°F, has been announced. The "Balancing Bi-Metal" is located in a separate compartment and is not affected by heat applied to the working bi-metal. The working bi-metal and the compensating bi-metal, identical in size and construction, are joined by a coupling bar. Relay has a calibrating screw that permits setting for the exact current required. It uses standard heaters and works equally well with either quick-trip or regular type. Available with all A-H magnetic starts in NEMA Sizes 0 through 5, the ambient compensated overload relay is supplied in ratings from 25 to 300 amps, continuous current. Normally supplied with manual reset, relays can be equipped with a change-over lever that provides manual or automatic reset, as required.

Arrow-Hart & Hegeman Electric Company, Industrial Control Div., 103 *Hawthorn St., Hartford* 6, *Conn.*

Annunciator System (24)

A new Trans-Alarm solid state annunciator with complete portfolio of circuitry for every alarm function is available. Components are the same as its other standard unitized types of conventional electromagnetic and mercury models, with a full range of window sizes for back-lighted engraved nameplates, turrent lenses and bulls-eye signal indication. Each individual annunciator point is a self-contained component in removable plug-in type assemblies making every signal station independent from every other station and may be removed separately from the fully prewired chassis.

Tigerman Engineering Co., 4332 *N. Western Ave., Chicago* 18, *Ill.*

Fittings (25)

Indenter set screw couplings and connectors have been added to this line of electrical fittings. Made of specially formulated soft steel for easy clinching, the indenter fittings feature extra heavy duty locknuts on rolled thread base. They are UL listed as concrete tight. Each fitting is zinc chromate plated for resistance to corrosion. Available in ½ in., ¾ in. or 1 in. sizes.

Electrical Tubular Products, 74-16 *Grand Ave., Maspeth, N. Y.*

Step and Night Lights (26)

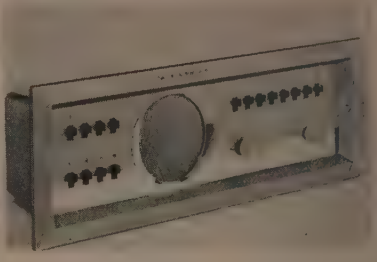
A new series of step and night lights to illuminate outdoor weathertight or indoor low-level lighting applications. Heavy-duty all-aluminum construction includes threaded entries and suitable gasketing for vaportight installations. Choice of cast louver face baked with glass panel, ¼-in. tempered glass diffuser or Holophane Hi-Stress asymmetric prismatic glass lens. Diffusers are caulked in face to insure watertight seal. Available in three sizes—for either surface or recessed mounting with cast aluminum external splice compartment for thru-circuit wiring and choice of incandescent or fluorescent lamps. Literature is available.

McPhilben Lighting, Inc., 1329 *Willoughby Ave., Brooklyn* 37, *N. Y.*

Capacitor (27)

New 50-kvar capacitor units for all 60-cycle voltages from 2400 to 13800 volts. Now 4 in. wide and with maximum height of 33½ in., these units retain the standard mounting dimension of 15⅝ in. for mounting in existing racks and blocks. They incorporate cooling features to maintain low internal operating temperatures for extended service life. They have been designed to meet all applicable NEMA standards for the performance and testing of shunt capacitors rated 2400 to 7960 volts. They are impregnated with low-temperature Elemex suitable for operation from minus 40°C to plus 46°C.

Line Material Industries, McGraw-Edison Co., Milwaukee 1, *Wis.*



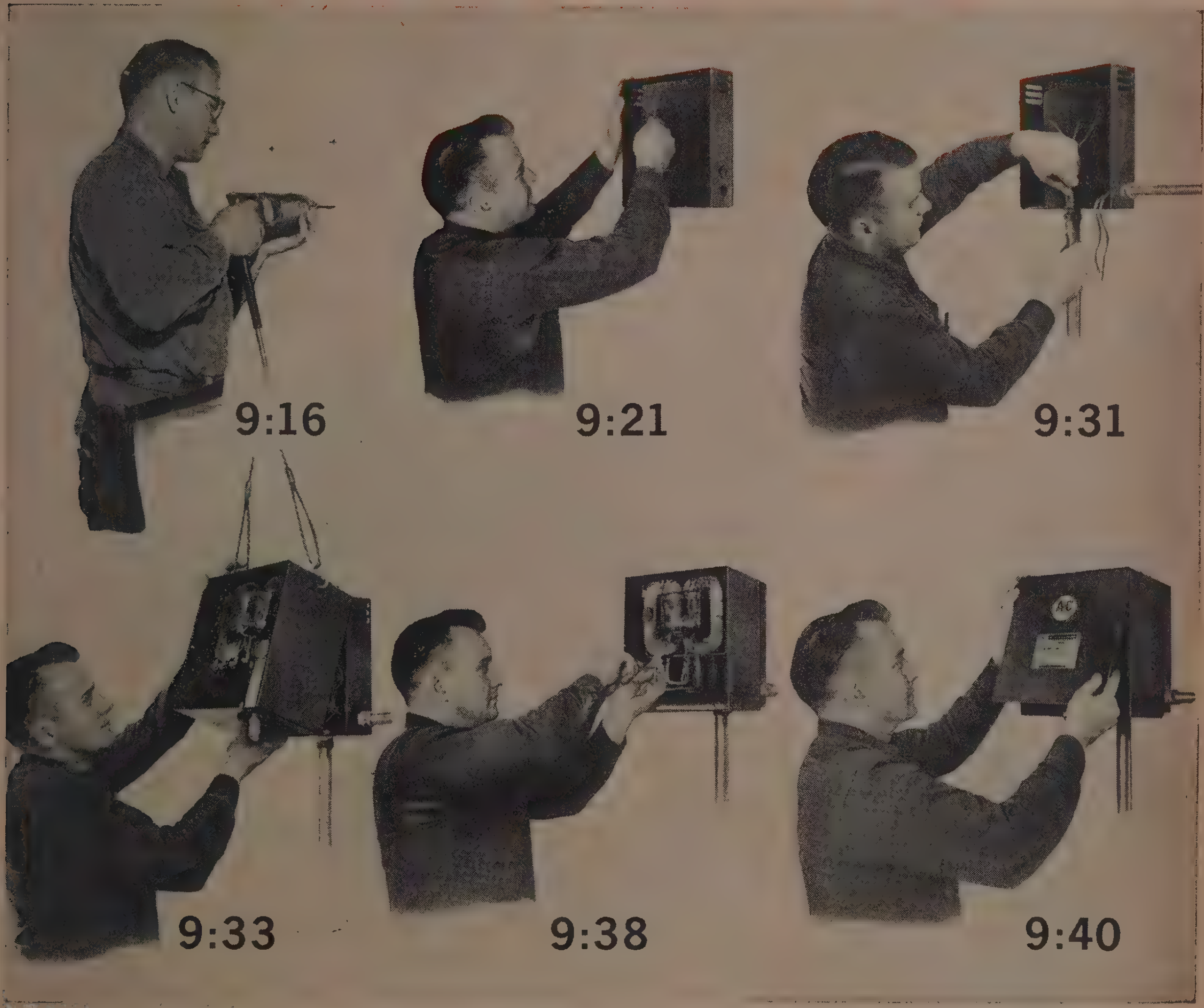
Intercom System (28)

A new 16-station home intercommunication system, designed to be interchangeable with an 8-station system to provide complete intercom as well as radio facilities for all interior and exterior areas of the home. Outside doors can be answerd from any room; conversations can be held between rooms; baby, children's or sick rooms can be monitored; private or non-private conversations can be held. Units can be flush mounted or surface mounted, making the system adaptable for homes already built as well as for new construction.

Talk-A-Phone Co., 5013 *N. Kedzie Ave., Chicago* 25, *Ill.*

ALLIS-CHALMERS

A-1360



9:16 — 16 minutes to drill 4 holes in concrete wall and add lead inserts to receive screws. 9:21 — 5 minutes to mount back panel to wall. 9:31 — 10 minutes to punch out knockouts and attach conduit. 9:33 — 2 minutes to put center case section in place and tighten side screws. 9:38 — 5 minutes to pull cables and connect to terminals. 9:40 — 2 minutes to fasten front panel to center section with side screws. **Installing time: 40 minutes instead of the usual hour and a half!**

35% smaller, lighter, new whisper-quiet dry-type transformers

cut installing time in half!

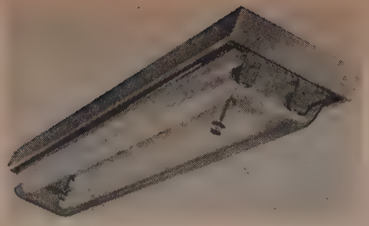
New A-C design eliminates common installation problems! Unique 3-piece case makes handling, wiring go like clockwork. 35% smaller and lighter, you can install them in 40 minutes instead of the usual 90 minutes.

And they're whisper-quiet. Every known factor in subduing noise has been incorporated . . . core impregnation, core and coil assembly suspension isolated from case . . . plus use of nonresonate casing. Exclusive *Curvacore* construction lowers exciting current, core losses.

This new 600-volt class indoor dry-type transformer line is available in sizes 3 to 50 kva . . . for on-the-site load center applications where critical voltage must be maintained.

See your nearby A-C office for details or contact **Allis-Chalmers,** *Power Equipment Division, Milwaukee 1, Wisconsin.*

Curvacore is an Allis-Chalmers trademark



Lighting Fixture (29)

A new dust and moisture resistant fluorescent lighting fixture for food handling and processing locations, is known as the "D.M.R. Unit." The smooth top permits mounting fixture flush against ceiling. A one-piece plastic enclosure allows visual maintenance inspection. Fixture can be hosed down. Unit is a 2-lamp, 4-ft unit for individual or continuous mounting. Available with either clear or diffusing Acrylic plastic enclosure. Booklet is available.

The Miller Company, Meriden, Conn.

Motor Controls (30)

A new line of motor controls designed to start, stop and protect electric motors on irrigation pumps and deep well pumps of the turbine and other similar types. Known as Type "IP" irrigation pump controls, units are electrically similar to combination starters, but are provided with special rain-tight enclosures. Each control is a single unit that consists of a fusible disconnect switch or a circuit breaker mounted in series with A-H Type "CRA" contactor. Two or three overload protective relays are provided. Enclosure is separated into two compartments. Upper section, which is not ventilated, houses disconnect switch and contactor. Overloads are isolated in lower compartment, which is adequately ventilated to prevent overheating and tripping of overload relays. Controls are supplied in NEMA sizes 1, 2, 3, 4 and 5 providing ratings up to 200 hp at 440-550 volts and are usually supplied in 3-pole construction for 3-wire, 2- or 3-phase power systems.

Arrow-Hart & Hegeman Electric Co., Hartford, Conn.

Lighting Unit (31)

New Gimbal ring light rotates 360° horizontally, tilts 30° vertically and accommodates a 150-watt PAR-38 spot or flood lamp. Unit is designed for use in stores, restaurants, lounges, theatres, display rooms and auditoriums. It features the patented "T.N.T." (Twist-N-Turn) mounting. Unit is recessed 8¼ in. into ceiling, has spring clip that allows removal of cover plate for access to outlet box. The 660-watt, 250-volt side prong socket is porcelain, heavy duty. UL listed.

Marketing Mfg. Co., 1531 *N. Kingsbury St., Chicago* 22, *Ill.*

Switch Plate (32)

A "Panelescent" electric light switch plate provides a guide light in a darkened room. The "Nite-Lite Switch Plate" may be used wherever there are single-toggle switches, including homes, offices, hotels, motels and factories. Switch plate contains a Panelescent lamp that produces enough light to be visible through the white plastic covering it. When a switch is turned off, the Panelescent light is activated and provides light. When switch is turned on, the Panelescent lamp is extinguished. It is listed by UL.

Sylvania Electric Products, Inc., 730 *Third Avenue, New York* 17, *N. Y.*

Troffer (33)

A new series of 4- by 4-ft troffers has been added to this line of recessed fluorescent lighting equipment. Troffers may be used individually or in conjunction with Speedomatic troffers. They are available with either of two shieldings—polystyrene plastic dish or plastic louvers. Shielding is contained in a door frame that hinges or opens from either of two sides. Troffers are available in three types.

Smithcraft Corp., Chelsea 50, *Mass.*

Combination Unit (34)

Three new aluminum enclosed meter socket—load center combinations are now available. Providing space for six 240-volt, 2-pole, circuits, the new combination units offer convenience of a meter socket and a circuit breaker load center within the same enclosure. Three ratings are available—100 amps, 150 amps and 200 amps. All have surface mounted raintight enclosures and are single-phase, 3-wire devices designed for installation on 120/240-volt ac systems. Insulated groundable neutrals are standard. For use in residential and farm line-pole applications, the units are listed by UL as non-interchangeable, Class NI service entrance equipment. They may be installed with G-E's new 70 and 100-amp Type TQAL plug-in breakers. Bulletin GEA-7075 is available.

General Electric Company, Plainville, Conn.

Motors (35)

A new line of fractional horsepower ac motors, called "Duty Master." Line is available in 1/20, 1/12, ⅛, ⅙, ¼, ⅓, ½ and ¾ hp ratings. Capacitor-start, split-phase, and polyphase units are made in frame sizes 48 and 56; repulsion-start induction-run models come in frame size 56. Open protected; totally enclosed, fan-cooled; totally enclosed, non-ventilated; and explosion-proof enclosures may be specified. Duty Master sleeve bearing motors may be mounted either vertically or horizontally with moderate end thrusts. Stator windings feature Mylar slot insulation with cuffed ends. Built-in thermal protectors operate in event of excessive motor temperature or excessive current input. Mounting is provided for either manual or automatic reset types.

Reliance Electric and Engineering Co., 24701 *Euclid Ave., Cleveland* 17, *Ohio*

INSTANT POWER

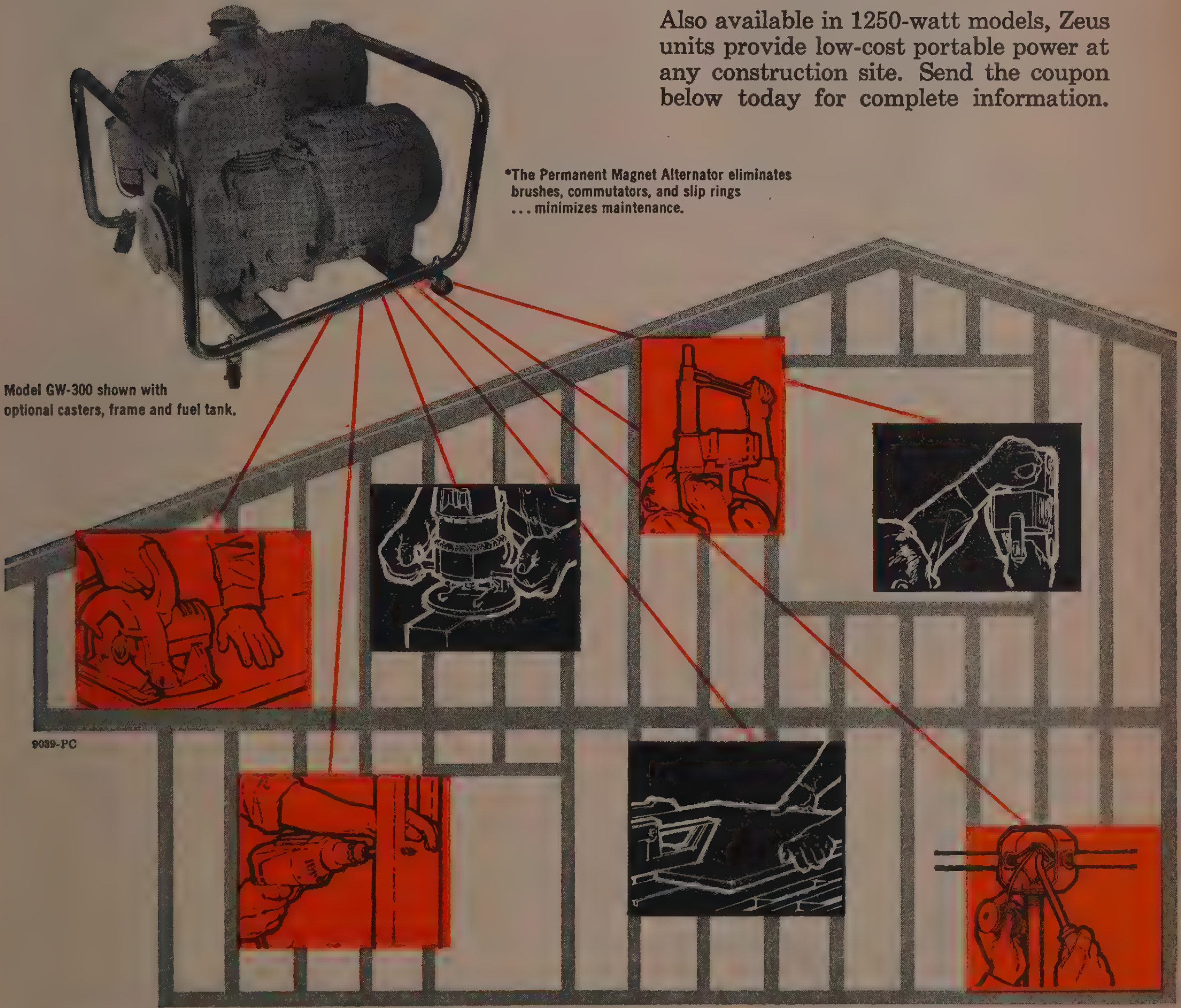
anyplace...anytime
with a

ZEUS

PORTABLE ELECTRIC GENERATOR

It's here! The new 3000-watt Zeus Portable Electric Generator now provides contractors everywhere with a *reliable* source of AC power . . . eliminates costly power-line installations . . . *pays for itself!* The job-proven Zeus features three fused outlets (115v & 230v) . . . dependable direct-drive gas engine . . . plus the exclusive Borg-Warner PMA* generator that *never wears out!* Lightweight Zeus generators deliver continuous full voltage for hours without overheating!

Also available in 1250-watt models, Zeus units provide low-cost portable power at any construction site. Send the coupon below today for complete information.



*The Permanent Magnet Alternator eliminates brushes, commutators, and slip rings . . . minimizes maintenance.

Model GW-300 shown with optional casters, frame and fuel tank.

9089-PC

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Please send me complete information about the following Zeus Portable Electric Generators ☐ 3000-watts ☐ 1250-watts.

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COMPANY________________________

STREET__________________________

CITY________________ZONE____STATE______

Only C-L-X® by Simplex

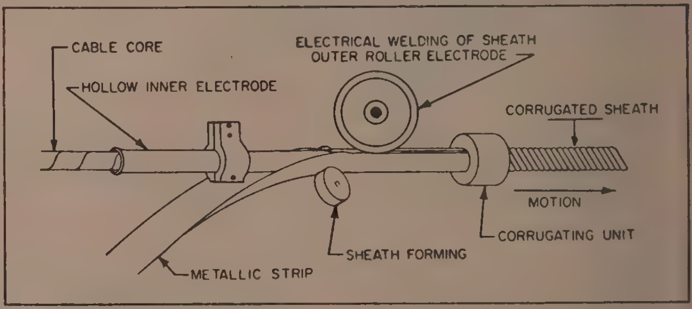
Continuous Lightweight eXterior

What C-L-X Is

Simplex C-L-X is a packaged combination of cable and a pliable, corrugated metal sheath that's impervious to liquids and gases. It requires no separate duct or conduit regardless of environment. It is available with sheaths of steel, copper, or aluminum with or without plastic jacketing.

C-L-X is manufactured by a unique, continuous process as shown in the sketch below.

C-L-X has the imperviousness of lead, the strength of conduit, and the pliability of a non-sheathed cable. No other system compares with C-L-X.



What C-L-X Does

Cuts Installation Costs

A Southeastern utility company needed a second feeder when the load capability of one of its substations was doubled.

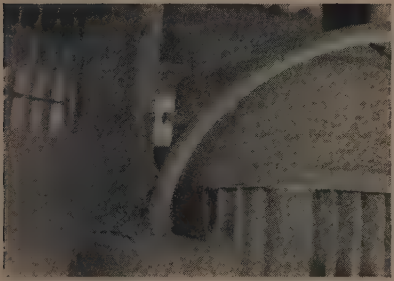
For reasons of economy they wanted a cable which would be used in a single length for both underground and aerial use. 3-conductor 500 MCM polyethylene-insulated, shielded 15KV C-L-X with polyethylene jacket was selected.

The route for the installation called for about 240 feet directly buried in the substation property with four 90-degree bends and one 45-degree bend from pothead to riser pole. The corrugated metallic sheath offered both mechanical protection and the necessary pliability for installation. A 705-foot aerial section called for a 5-degree sweep and a 30-degree bend near the pothead on the field end of the cable.

C-L-X was installed as a single length for both buried and aerial sections. The buried section was laid in a 3-foot deep trench with a 3-inch layer of sand above and below the cable.

A utility engineer states "only 2½ days were required for the installation of the cable, exclusive of splicing." A saving of more than $20,000.00 was realized by using C-L-X instead of a complete underground duct system. The carrying charges saved by this plan will pay for the present feeder in about three years.

Sealed Cable Systems Can do so many Jobs So Well



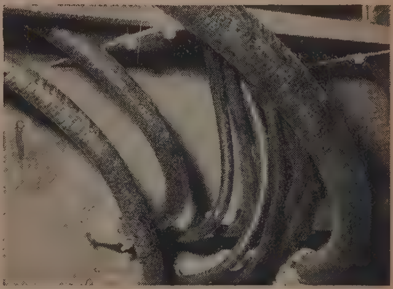
Resists Chemical Attack

This company had a corrosion problem with the electrical system in its calcium chloride reclamation building. Due to the highly corrosive atmosphere of the building, conduit life was only 6 to 9 months. The conduit was replaced with a C-L-X cable system. Now, after two years of operation, the C-L-X system is still performing perfectly, shows no signs of deterioration.

Offers Unique Pliability

An oil refining plant was faced with an unusually difficult wiring installation involving both power and control.

After examining every usable cable, refinery engineers selected C-L-X because it met the following requirements: (1) C-L-X could be made explosion-proof with the use of proper terminators. (2) C-L-X could be made in a continuous run for the lengths required, regardless of diameter. (3) The bending radii of C-L-X cables were sufficiently small to allow them to snake through a jungle of existing pipes.



Protects Against Liquids and Gases

An East Coast petroleum tank farm needed power and control wiring from a control panel to a series of motors used to circulate high octane fuel. Since an underground installation was desired, and the ground was saturated with oil, gas and water, it was imperative that the cable be completely liquid-tight and gas-tight.

A C-L-X 8-conductor cable protected with PVC solved the problem perfectly. In addition, installation cost was far lower than that of unprotected cables pulled into conduit.

What C-L-X Can Do for You

Whenever you're faced with a difficult installation of power, communications or control cables — or combinations — remember this important fact: ***Only Simplex C-L-X cable systems offer you all of these advantages...Exceptional Strength...Unequalled Pliability...Protection from Liquids and Gases...Faster Installation.***

Send for Illustrated Brochure
Containing Application and Engineering Data

SIMPLEX
WIRE & CABLE Co
Cambridge, Massachusetts

SIMPLEX WIRE & CABLE CO., 79 Sidney Street, Cambridge, Massachusetts

☐ Please send me a copy of your Simplex C-L-X brochure.

☐ Please have representative call.

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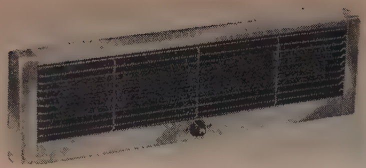
COMPANY..

STREET..

CITY.................. ZONE..... STATE..........



Baseboard Heater (36)

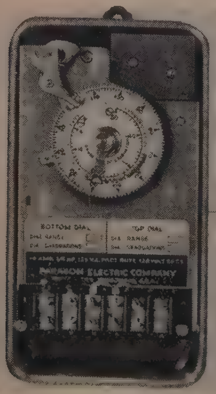
A new electric glass radiant baseboard heater is for use in the bathroom. Cat. No. BBT600, is a 2-ft baseboard rated at 600 watts for operation on either 120 or 240 volts. Heater is designed for installation on surface of wall just above the sanitary base. It extends but 2 in. from wall. Heater features a built-in automatic thermostat. It is available in either a polished chrome finish or satin grey enamel which may be painted to blend with color scheme of bathroom.

Berko Electric Manufacturing Corp., 212-40 Jamaica Ave., Queens Village 28, N. Y.

Switches (37)

New double-pole toggle and rocker switches. Double-pole toggle switches are rated 20-amp, 125-volt, ac 1½ hp; 10-amp, 250-volt, ac 2 hp with full 20-amp, 250-volt, ac for non-inductive load. With a choice of mounting arrangements, terminals and circuitry available, switches are adaptable to a variety of heavy-duty industrial applications. The new 20-amp, 125-volt rocker switches are available for flush or offset 2-hole mounting.

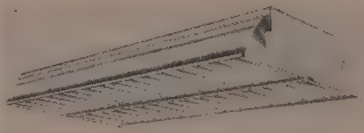
McGill Manufacturing Co., Inc., Valparaiso, Ind.



Timer (38)

A new repeat-cycle automatic timer with concentric dials incorporated within a single mechanism to close and open a load circuit in a timed sequence. On and Off operations are independently and infinitely adjustable. In operation, power is applied to new device through a sustained contact pilot switch. Frequency of switch action is controlled by bottom frequency dial, and load operation by top timing dial. When load switch actuates, frequency dial resets to zero. The single-pole double-throw load switch energizes the load circuit for the period of time set on timing dial. In event of power failure, frequency dial holds its position and continues on when power is restored.

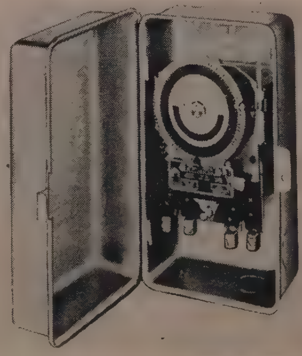
Paragon Electric Co., Two Rivers, Wis.



Troffers (39)

New aluminum troffers for Power Groove lamps are designed to provide maximum brightness control of the high-output lamps. Fixtures are available in single and twin sizes. Nominal unit lengths of single troffers are 4, 8 and 16 ft; twin troffers, 4 and 8 ft. Catalog is available. They are for use in offices, stores and public buildings.

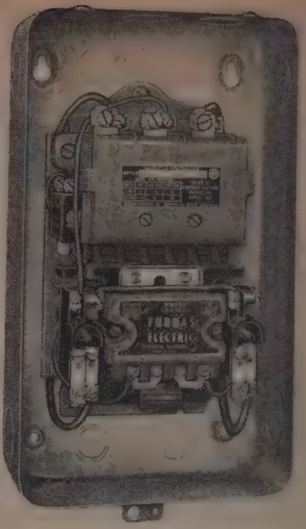
The Miller Company, Meriden, Conn.



Time Switch (40)

A new 14-day time switch is used to turn a motor On one week and Off the next, and is designed specifically to allow pumps, motors, or other equipment to "rest." Called Model 14D1197, it is a single-pole double-throw switch. Every seven days the unit "make-breaks" to put one set of equipment on and the other off.

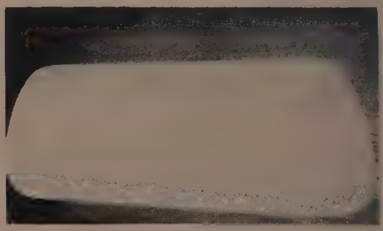
Tork Time Controls, Inc., Mount Vernon, N. Y.



Motor Starters (41)

A new concept in motor control design through 30 hp 550-volt offers unitized construction with all components front removable. Features include plug-in type pushbuttons or selector switches, easily added in the field. Thermal overload relays with trip indicator are trip-free and tamper proof. Thermal overload can be added in field without changing enclosure. Magnet coils are molded type dual voltage, 110/220 or 220/440, dual cycle, 50-60. Coil has molded terminal board eliminating leads. Up to three auxiliary interlocks for pilot duty may be added. Bulletin 14-B2 is available.

Furnas Electric Co., 1000 McKee St., Batavia, Ill.



Lighting Fixture (42)

A new wall fixture designed primarily as a mirror light in bedrooms and bathrooms. Fixture is rated for two 100-watt bulbs, can be mounted vertically or horizontally to any standard electrical outlet box, and measures 6 in. by 17¾ in. by 5 in. deep. Its contemporary glass is hand-blown in satin-finished Thermopal. Glass is hinged so that it can be swung away for cleaning or relamping.

Prescolite Manufacturing Corp., 2229 Fourth St., Berkeley, Calif.

WORLD'S MOST WIDELY USED ELECTRICAL TEST INSTRUMENTS

AMPROBE®

THE ONLY LINE THAT COVERS ALL YOUR TESTING NEEDS

The original pocket size snap-around volt-ammeter-ohmmeter

AMPROBE RS-3

5 current ranges. 3 voltage ranges. Ohmmeter specially designed for the maintenance field. Rotary scale for faster reading and greater accuracy. Pointer-Lock "freezes" pointer at reading. Advanced printed circuitry laughs at rough handling. Advanced movement design—new internal core magnet with self shielding characteristics. By itself, the Amprobe RS-3 handles 99% of your test needs. With the Amprobe Deca-Tran and Amprobe Energizer it covers EVERY testing situation. *Only* **$52.50**

AMPROBE RS-1

The economy snap-around volt ammeter with many features of the great RS-3 including rotary scale, pointer lock, printed circuit, and advanced movement design. 4 current ranges. 2 voltage ranges. *Only* **$39.85**

AMPROBE JR.

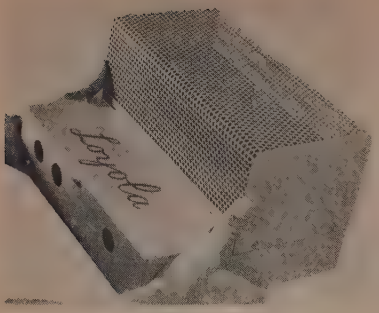
The advanced voltage tester that gives you current, too. Available in seven models, ranging from 10 amps to 100 amps in either 125/250 or 150/600 volts. Choose the model that fits your job. *Only* **$19.85**

AMPROBE TEST-MASTER KIT

Keep all your electrical-test tools right at hand with this rugged, genuine cowhide leather carrying case. The Amprobe **Test-Master Kit** contains either the RS-3 or RS-1, the Amprobe **Deca-Tran** (extends amperage readings 10x; as high as 1200 amps), the Amprobe **Energizer** (multiplies sensitivity of any Amprobe 10x for readings on small appliances and fractional h.p. motors), and a separate covered section to hold your small hand tools within easy reach.

Model TM-33 (with the RS-3): *Only* **$84.50**
Model TM-11 (with the RS-1): *Only* **$71.75**

PYRAMID INSTRUMENT CORPORATION, LYNBROOK, N. Y. WORLD'S LARGEST MANUFACTURER OF SNAP-AROUND VOLT-AMMETERS.



Power Manipulators (43)

Model LC-2 and LC-3 power manipulators control the ac power to furnaces and other resistive loads from 0 to 95%. Units are available to handle power loads up to 11 kva on 120-volt 60-cycle lines and 22 kva on 240-volt 60 cycle lines at efficiencies greater than 99%. A drive current of 1.5 ma dc can reduce the power to the load from 95% to 0%.

Loyola Controls, Box 90074, *Airport Station, Los Angeles* 45, *Calif.*

Grounding Devices (44)

Seven new 20-amp grounding devices meet requirements of revised NEC. The line includes single and duplex receptacles, also available with round covers and a U-Ground cap. The 5800 Series devices are constructed to heavy-duty specification grade standards. Features are shallow bodies; side wiring; break-off links for 2-circuit wiring; double grounding screws and rustproof covers for both 3¼ in. or 4 in. outlets. Listed by UL.

Leviton Manufacturing Co., Inc., Brooklyn 22, *N. Y.*

Transformers (45)

Tamper-proof transformers for pad-mounted applications in residential sub-divisions and shopping centers are now available in 25 to 2500-kva ratings. Available in single-phase units 25 through 167-kva and 3-phase units 75 through 2500-kva. Units are completely tamper-proof and accident-proof. Both high and low voltage terminal compartments are protected by padlocked doors and are flush with bottom of transformer base. Units are designed to be mounted on level concrete foundations with underground connections. Side-by-side arrangement of terminal compartments provides for installation of larger capacity transformers without disturbing incoming or outgoing feeders. The two compartments are completely isolated from each other by a steel barrier without opening.

General Electric Co., Schenectady 5, *N. Y.*

Transformers (46)

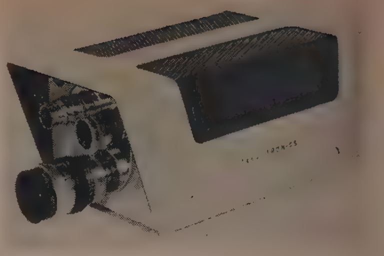
A new line of pole-mounted distribution transformers is presently available through 10 kva and will soon be available in all sizes of the distribution transformer line. External mechanical features of the line include a deep-drawn, crowned cover; captive center-bolt hand-hole closure; reduction in cover hardware; weep-holes in clamping band.

Moloney Electric Co., St. Louis 20, *Mo.*

Safety Switches (47)

New heavy-duty, Type TH, and heavy-duty interrupter, Type THD, switches are capable of withstanding a 200,000-amp short circuit when used with G-E CLF high capacity or other current-limiting fuses of comparable characteristics as defined in NEMA Standards FU1-1959. The enclosed safety switch is capable of protecting heavy electrical equipment installed where available short circuit current exceeds 100,000 amps. THD switches are available in ratings from 30 to 600 amps, 250 and 600 volts ac; Type TH devices, available in same ratings. They feature visible blades, lugs for copper or aluminum conductors, and are listed by UL.

General Electric Co., Circuit Protective Devices Dept., Plainville, Conn.



Camera (48)

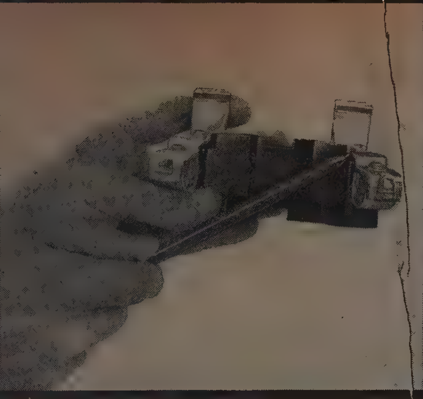
A high-resolution type television camera, Model 700, with the option of built-in sound channel for intercom and educational TV applications requiring crisp voice communication has been announced. Circuit features are low-noise Cascode video input; 8 mc video bandwidth amplifiers; linear phase type aperture correction; automatic target sensitivity control; interlacing sync. generator; no-scan protection circuitry for Vidicon; totem-pole high-level video output; remote control of beam, target and focus.

Tele-Tronics Corp., 12786 *Western Ave., Garden Grove, Calif.*

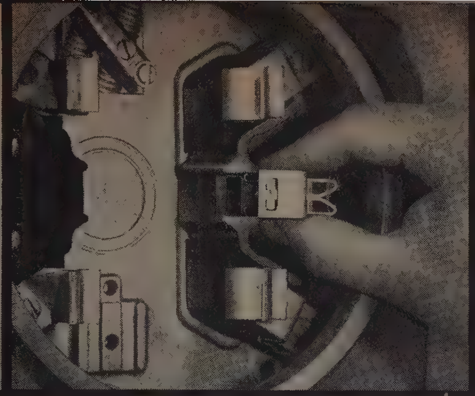
Boxes (49)

Three new series of completely interchangeable FS boxes accommodate virtually every cover, plate and wiring device. Included are weatherproof boxes taper-threaded for rigid conduit, boxes with special "rivet-point" locking set-screws for thin-wall EMT and a complete specification-grade line with deluxe compression fittings to cut installation time in half in severe-service locations. Boxes are die-cast aluminum in a new design. All three series are UL-listed and available in ½ and ¾ in. sizes in ten different hub styles, with or without additional back-holes. Bulletin EFS is available.

Stonco Electric Products Co., Kenilworth, N. J.



NEW S-2 TERMINAL BLOCK ASSEMBLY—with exclusive one-piece combination jaw and connector strap—permits an unbroken current path from meter blades to line wires for excellent electrical conductivity, low heat rise, for added reliability.



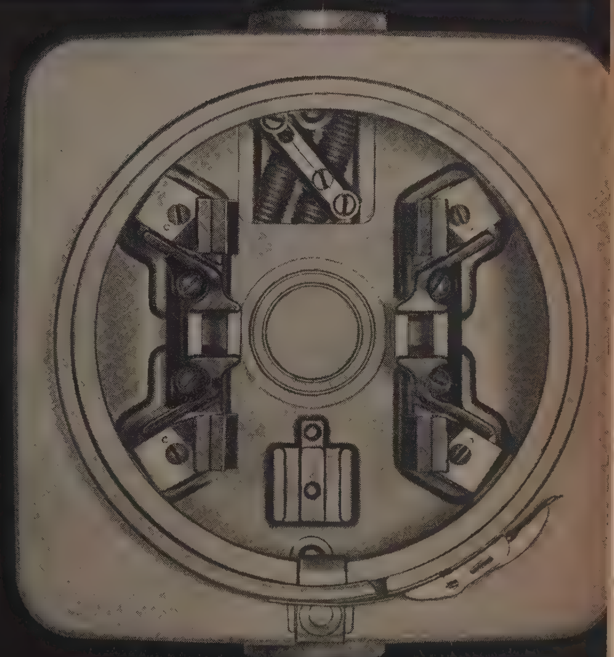
NEW PLUG-IN TERMINAL, another General Electric S-2 exclusive, installs in seconds—without tools, and without removing any part of the meter socket . . . greatly simplifying shop or field conversion to five or six terminal sockets.

EXCLUSIVE SQUARE DIE-CAST ALUMINUM CASE—with baked-on all-weather finish — gives maximum strength, corrosion protection . . . provides full raintight construction . . . unitized hubs. And, modern styling eliminates sharp, hazardous corners.

General Electric Announces...

NEW S-2

SQUARE METER SOCKET



General Electric S-2 sockets—for all 100-amp services—offer two **exclusive** new features providing greater reliability, increased versatility.

GREATER RELIABILITY is provided by unique one-piece combination jaw and connector strap—permitting an unbroken current path from meter blade to line or load wires with minimum heat rise.

INCREASED VERSATILITY results from the only true plug-in terminal on the market today . . . installs in seconds—without tools—for easy conversion to five or six terminal socket.

PLUS 6 EXTRA VALUE FEATURES

1. Largest wiring space of any die-cast socket—144 cubic inches—permits fast, easy wiring.
2. Die-cast aluminum case—plus baked-on finish—protects against corrosion and weather.
3. Lay-in wire connectors accommodate both aluminum and copper wire.
4. Positive one-way knockouts provide a perfect knockout every time . . . eliminate prying or bending.
5. Choice of neutral connectors—two channel or single lay-in neutral connector.
6. Unitized hubs are cast as part of case . . . no extra charge for second hub at bottom.

NOW AVAILABLE. *Contact your G-E Sales Office or Authorized Distributor for full S-2 information. Or, write General Electric Company, Somersworth, N. H.* 711-01

METER DEPARTMENT

GENERAL ELECTRIC

Control Centers (50)

Redesigned motor control centers are available with bus ratings from 600 to 1600 amps and voltage ratings from 110 to 600 volts. Horizontal buswork can be installed at either top or bottom of 20-in. wide by 20-in. deep motor control centers. Vertical buswork is braced for 50,000 rms. Six vertical bus supports are of nonbreakable, glass-filled polyester and are curve molded. Vertical wiring troughs have been expanded in area from 27 to 30 sq in. and conduit openings are 14 by 14 in. A plug-in terminal block is now standard.

Allis-Chalmers Manufacturing Co., Milwaukee 1, Wis.

Drop Light Reels (51)

The grounding-type drop light reel, Model 800-G, is designed for maximum safety. UL listed grounding-type moulded plug cap fits all standard grounded electrical outlets. The phenolic pistol-grip handle has grounded swing-open reflector guard, Levolier toggle-action switch and socket; built-in strain relief and grounding-type side convenience outlet. When not in use, the cord automatically retracts into its reel housing. All hardware is included for 180° wall mounting swivel or 360° full rotation ceiling mounting. Available in 20-ft lengths.

Cordomatic Corp., 17th & Indiana Ave., Philadelphia 32, Pa.

Plastic Conduit (52)

Two new lines of rigid plastic electrical conduits have been announced. Rigid PVC polyvinyl chloride plastic conduit, designed for both above and underground installations, is available in two types. Type A light wall and Type II heavy wall plastic conduits are gray in color and produced in the full range of trade sizes ½ in. through 6 in., in 10-ft and 20-ft lengths. Assembly fittings include couplings, adapters, elbows and a complete line of conduit access fittings available in all sizes.

Wheatland Electric Products Co., 500 Logan St., Carnegie, Pa.

Product Briefs

(53) The Glastic Corp., Cleveland, Ohio, has added three new sizes to the line of U-shaped **stator wedges** for electrical motors—widths of 5/16 in., 11/32 in., and 3/8 in. . . . (54) New line of "Two-Hole" **snap straps** announced by Holub Industries, Inc., Sycamore, Ill., is made to snap on the conduit leaving both hands free for nailing.

(55) The new "Dazy" hollow **wall anchor** is now available from the Arrow Expansion Bolt Co., Marion, Ohio. . . . (56) The Wiremold Co., Hartford, Conn., has developed a **cutting box** for straight or mitered cuts designed to facilitate cutting of their Plugmold 2200 multi-outlet system raceway.

(57) Columbia Cable and Electric Corp., Brooklyn, N. Y., announces the development of a new nonmetallic sheathed **cable**. . . . (58) Complete line of rigid aluminum **conduit** in ½ to 6 in. sizes has been introduced by Clayton Mark & Co., Evanston, Ill.

(59) Plymouth Rubber Co., Inc., Canton, Mass., has introduced a new instant **tape dispenser** and case called the "Flip 'n' Cut" designed to hold the standard 66-ft roll of Slipknot No. 7 plastic electrical tape. . . . (60) New dual-phase, gasoline-driven electrical **generating plants** have been developed by D. W. Onan & Sons Inc., Minneapolis, Minn.

(61) International Resistance Co., Plastic Products Div., Philadelphia, Pa., has developed a new type of **insulating tape** for use in electrical equipment, transformers and motor coils . . . (62) The new Ditch Witch crawler **trencher** is available in either 9 or 12 hp models from the Charles Machine Works, Inc., Perry, Okla.

Catalogs & Bulletins

(63) CONTROL CABLE. 4-page bulletin describes all - thermoplastic small-diameter control cable. The Okonite Co.

(64) TRANSFORMERS. 8-page Bulletin 160 features full line of new Class B dry-type transformers. Niagara Transformer Corp.

(65) HEATING UNITS. New "Infra-Mite" infrared heating units are described in literature. Apextro Products Co.

(66) ELECTRIC and electronic controls in commercial and industrial air conditioning installations are covered in new handbook entitled "The Electronic Handbook." Barber-Colman Co.

(67) MAGNETIC contactors and starters, Size 00, which have been added to the 100 line are described in Bulletin GEA-7304, 4 pages. General Electric Co.

(68) ELECTROPLATING PROCESSES. 24-page bulletin gives a brief description of 18 available electroplating processes. Hanson-Van Winkle-Munning Co.

(69) LIGHTING FIXTURE catalog "Gallery of Lighting Inspirations" features an exclusive handcrafted collection of lighting fixtures inspired by the Great Masters. Gill Glass and Fixture Co.

(70) TRANSISTORIZED modular power supplies packaged to permit proper dissipation of heat and fast replacement of components are described in four-page brochure. Dressen-Barnes Corp.

(71) SWITCH. Loadmaster 100, a fused interrupter switch, is described in bulletin. Pennsylvania Transformer Div., McGraw-Edison Co.

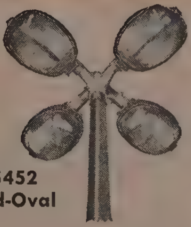
(72) CONTROLS. Catalog 62 contains photographs, drawings and descriptions of 19 types of Tachometers. Jones Motrola Corp.

(73) HEAVY DUTY trolley busway electrical distribution systems are described in 32-page Bulletin No. 80. Feedrail Corp.

(74) INDUSTRIAL SOLDERING IRONS. Bulletin GEC-1545, 4 pages, describes complete line of production soldering irons for use on all electronic equipment, meters, and instruments. General Electric Co.

No. 8700 Series
luorescent Floodlight

No. 5442
Ultra-Lite



No. 5452
Quad-Oval

No. 7400 Series Floodlight

Widest line of fixtures lets you light malls and parking lots the one best way for each job

There's one *best* way to solve each application problem in lighting parking lots, shopping malls, or other outdoor areas. Planned with Revere Fixtures, you can do the job at hand without compromising on the type of equipment required to do it the best way.

Revere offers the widest line of outdoor lighting equipment of any manufacturer. You can choose exactly the components you need — hinged or rigid poles . . . mercury, incandescent or fluorescent luminaires—floodlights, fixtures and fittings. All Revere components are matched for easy installation, strength and balance, peak lighting efficiency and attractive appearance, too.

Revere's outdoor lighting catalog makes it easy for you to select equipment to solve more outdoor lighting problems of any type with fixtures that are best for the job. Write for your copy. Consult your Revere wholesaler about your next outdoor lighting job.

Revere ELECTRIC MFG. CO.®

OUTDOOR LIGHTING

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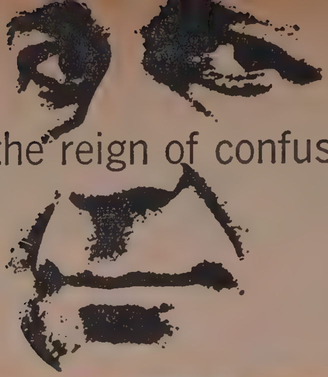
Long Distance Phone: Niles 7-6060 • Chicago Phone: SPring 4-1200 • Telegrams: WUX Niles
In Canada: Curtis Lighting, Ltd., Leaside, Toronto, Ontario



the reign of confusion is over

E 15-100 amps, 240 volts a-c,
125 volts d-c, 1, 2 and 3 poles
IR @ 240 volts a-c: 7500 amps

FA 15-100 amps, 600 volts a-c,
250 volts d-c, 2 and 3 poles
IR @ 240 volts a-c: 20,000 amps
Replaces: EH, F and G breakers
Check Westinghouse for availability of this newest breaker.

JA 70-225 amps, 600 volts a-c,
250 volts d-c, 2 and 3 poles
IR @ 240 volts a-c: 25,000 amps
Replaces: J breakers

Newly Designed Westinghouse Breakers

The confusing assortment of letters that tagged the breakers of the past should trouble you no more. The reason: clear-cut designations for the new smaller size Westinghouse breaker family.

New designations mean that specifying is simple . . . identifying each breaker is easy.

High interrupting ratings in smaller frame sizes mean you save as much as 50% on space.

The Westinghouse design means that you have extra-long life, unfailing reliability.

KA 70-225 amps, 600 volts a-c, 250 volts d-c, 2 and 3 poles
IR @ 240 volts a-c: 30,000 amps
Interchangeable Trip
Replaces: JK and K breakers

LA 125-400 amps, 600 volts a-c, 250 volts d-c, 2 and 3 poles
IR @ 240 volts a-c: 50,000 amps
Interchangeable Trip
Replaces: KL and JKL breakers

MA 125-800 amps, 600 volts a-c, 250 volts d-c, 2 and 3 poles
IR @ 240 volts a-c: 50,000 amps
Interchangeable Trip
Replaces L, M and LM breakers

J-30320

Are Simple to Specify/Easy to Identify

Any way you look at it, the NEW Westinghouse breakers are the ones you'll want to use.

More information? Contact your nearest Westinghouse representative, Westinghouse distributor, your independent panelboard builder . . . or write Westinghouse Electric Corporation, Standard Control Division, Beaver, Pa.

For a large, plastic laminated wall chart of the new breaker line, write Westinghouse.

All Westinghouse AB breakers meet or exceed NEMA and UL specifications.

You can be sure . . . if it's Westinghouse

(75) TELEPHONE SYSTEMS. 6-page brochure covers the wide variety of functions provided by private automatic telephone systems and the new Dial Flexifone. Commercial Sound Div., DuKane Corp.

(76) MAGNET WIRE. 4-page folder gives complete specifications on new super Gentherm. General Cable Corp.

(77) MOTOR. New integral squirrel cage induction motor is described in 12-page bulletin. Century Electric Co.

(78) NYLON CABLE TIES and straps for securing and identifying wiring bundles are described in new 4-page Bulletin TR-3. The Thomas & Betts Co.

(79) HAND TOOLS which are custom-made to cope with unusual assembly and service problems are featured in Bulletin 660. Xcelite Inc.

(80) THEATRICAL CONTROL SYSTEM for complete control of stage lighting, rigging and elevating is described in Bulletin EPD 5006-1. Vickers Inc.

(81) SWITCHES. 4-page bulletin 701 describes line of Loxswitch heavy duty and precision limit switches for machine tools. R. B. Denison Mfg. Co.

(82) CAPACITORS. Bulletin describes Fast Series 55 motor-run capacitors for air conditioning, refrigeration, fluorescent lighting ballast, heating, ventilating, and general industrial use. John E. Fast & Co.

(83) SPEED CONTROL. Bulletin GEA-7202, 8 pages, describes shipboard line of ac reactor speed control. General Electric Co.

(84) TRAVEL SWITCH. 2-page data sheet contains information on new adjustable differential travel switch. Micro Switch.

(85) SEALING COMPOUND. Duxseal, an all-purpose sealing and caulking compound for a variety of industrial and electrical applications, is described in 4-page brochure IN-318A. Johns-Manville Corp.

(86) HEATING ELEMENT. Uses of single and double embossed "Panelcoil" for heating and cooling are illustrated in new data sheets M12 and M13. Dean Products, Inc.

(87) CONVERSION FACTOR chart in wall chart form includes common conversions such as inches to centimeters or watts to hp. Precision Equipment Co.

(88) POWER CENTER. New "Regu-Tran" unit assembly consisting of regulators, power transformer, and switches is described in Bulletin 61B9695. Allis-Chalmers Mfg. Co.

(89) SERVICE EQUIPMENT. New guide for 1961 lists the latest in service equipment in both the fusible and circuit breaker devices. Wadsworth Electric Mfg. Co., Inc.

(90) LADDER Catalog L-97 contains 24-pages of information on "Gold Medal" step, single and extension ladders and accessories. The Patent Scaffolding Co., Inc.

(91) STATIC CONTROL. Bulletin GEA-6578A, 8-pages, describes line of static control with detailed pictures and diagrams. General Electric Co.

(92) ARMATURE WINDER. Bulletin 605-AL describes new automatic armature winder with automatic commutator hook-up feature. Possis Machine Corp.

(93) HEATERS. Specification data, drawings, illustrations and operating charts are provided in 6-page Booklet F40100-1 on Chromalox electric Fintube airduct heaters. Edwin L. Wiegand Co.

(94) CONDUIT and cable seals, insulating bushings, cable supports and terminators are illustrated in Bulletin A-460. The Adalet Mfg. Co.

(95) SWITCH. 2-page data sheet No. 180 covers the new high sensitivity subminiature switch. Micro Switch.

(96) WIRE AND CABLE. 24-page catalog describes products in easy to find forms; tables and specifications relating to various kinds of conductors are included. Ettco Wire and Cable Corp.

(97) STREET LIGHTING. Bulletin GEA-7210, 10 pages, describes new mercury luminaire for residential street lighting. General Electric Co.

(98) ELECTRICAL WIRING DEVICES, lamps and specialty products are listed in 84-page catalog. Eagle Electric Mfg. Co., Inc.

(99) RACEWAY. Catalog contains product illustrations and detailed information for specifying and installing Headerduct cellular floor feeder raceway. Wheatland Electric Products Co.

(100) PUSHBUTTON UNITS. Double color-coded pushbutton line with exclusive wipe-action contact design is described in Bulletin PL 100-1-960, 8 pages. The Clark Controller Co.

(101) CIRCUIT BREAKER and load center line is presented in 8-page booklet. Murray Mfg. Corp.

(102) DOOR INTERLOCK SWITCHES. Data Sheet No. 178 covers three series of door interlock switches with thermoplastic actuating rods. Micro Switch.

(103) SPEED DRIVES. Bulletin GEA-6806, 16 pages, describes the new ¼-25 hp line of Polydyne mechanical adjustable speed drives. General Electric Co.

(104) PORTABLE INDUSTRIAL LIGHTING. 12-page bulletin provides information on the types, construction details and varieties of stock components from which individualized portable lighting systems can be assembled. Joy Mfg. Co.

(105) CONNECTORS. Data Folder No. 6008 contains technical data on H tap compression connectors. Jasper Blackburn Corp.

(106) LENS PANELS. Catalog sheet covers the white opal and polystyrene prismatic lens panels. K-S-H Plastics, Inc.

(107) WIREWAYS, fittings and enclosures designed to meet JIC and NEMA Standards are described in 16-page Catalog No. 159-D. Keystone Mfg. Co.

(108) HIGH-VOLTAGE DISTRIBUTION. Bulletins 60118 and 60119 illustrate equipment especially designed for 20/34.5-kv distribution systems. Line Material Industries, McGraw-Edison Co.

(109) CONTROL CENTER. Bulletin GED-4152, 4 pages, gives latest achievements in the art of motor control centers. General Electric Co.

(110) SCHOOL HEATING. Heating schools electrically is subject of 4-page Bulletin F00-101-1, including installation illustrations, specifications and product application data. Edwin L. Wiegand Co.

(111) LIGHTING. Fluorescent Lighting Catalog No. 12A features commercial fluorescent lighting equipment and all modular sizes and types of plastic and metal diffusers. Neo-Ray Products.

(112) FUSE PANELS, service entrance equipment and switches are featured in Booklet No. PL 12-29-660, 20-pages; includes installation and application data on their complete line. The American Electric Switch Div., Clark Controller Co.

(113) SWITCHES. Adjustable pulse switch, center neutral limit switch

and proximity switch are featured in new circular "Switches for Industry" — Form 84-441. Micro Switch.

(114) HEATERS. Bulletin F70100-2 covers illustrations, application information, features and specification data on far-infrared radiant heaters. Edwin L. Wiegand Co.

(115) PHOTOELECTRIC CONTROL devices for a variety of sensing applications and light sources are described in new 24-page catalog. Autotron, Inc.

(116) MAGNETIC and electronic equipment are illustrated and described in new product index. Acme Electric Corp.

(117) CONTROL PILOT DEVICES. GEA-7302, 8-pages, describes line of control pilot devices which includes pressure and vacuum switches, pressure governor, plugging and anti plugging switches, float switches, pilot switches and manual reversing switches. General Electric Co.

(118) SWITCHES. 4-page booklet features the new Feathertouch twin switch line. H. J. Theiler Corp.

(119) LIGHTING. Two new catalogs entitled "Octagonal Tapered Steel and Aluminum" and "Aluminum Round Tapered" feature new designs in both street and area lighting standard equipment. Kerrigan Iron Works Co.

(120) INDUSTRIAL SOUND SYSTEMS and components are illustrated in brochure and detailed specification sheet. North American Philips Co.

(121) ELECTRICAL CONNECTORS, receptacles, switches and lighting products are illustrated in Bulletin B81. Joy Mfg. Co.

(122) EPOXY RESINS. New technical bulletin describes methods of applying epoxy resins to motor windings. John C. Dolph Co.

(123) RACEWAYS. 12-page booklet contains complete engineering data on surface wiring raceway systems. The Wiremold Co.

(124) FLOODLIGHTING. 4-page folder illustrates five "Econoflood" floodlight beam spread models. Appleton Electric Co.

(125) POWER CENTER. "How to Select I-T-E Power Switching Centers" a guide to selecting and specifying metal-enclosed coordinated load-interrupter switch and fuse assemblies. I-T-E Circuit Breaker Co.

only ONE plier gives you BOTH
THESE POWER-GRIP FEATURES

Machined, Undercut Channels. Smooth working, can't slip under any load!
Reinforcing flange for added strength where you need it!
CHAN NEL LOCK®
CHAN NEL LOCK Nº 420
CHAMPION DEARMENT MEADVILLE, PA. U.S.A.

Only CHANNELLOCK gives you these power-grip features. That's why thousands of skilled mechanics—year in, year out—buy CHANNELLOCK in preference to any other plier. They prefer its terrific gripping power, its all 'round usefulness. And you will, too! Available in three jaw capacities: 7/8", 1½" and 2". Ask your tool supplier for a *genuine* CHANNELLOCK Plier. If he's out of them, ask him to order one for you.

Write for Catalog of Complete Line of Pliers

CHAMPION DEARMENT TOOL COMPANY
MEADVILLE 6, PENNSYLVANIA

FREE

Bolt Cutter

Wire Cutter

Indentor

Wire Strippers

Thread Chasers

Insulation Grip Closers

with the

HYLUG KIT #11

Come and get 'em . . . a $3.95 tool FREE in every kit . . . a tool with all the features you've been looking for . . . crimper and wire cutter in the nose, wire stripper, the slickest bolt cutter you've ever seen . . . and handles that fit your hand like a glove. And what a buy in the kit itself . . . 250 one-piece HYLUGS packed in 3 Flip-Top boxes . . . 18, 14 and 10 sizes. Flip them out as easily as you flip a cigaret out of its pack. This is an offer you don't want to miss. Don't wait . . . call your local BURNDY distributor now . . . he has kits in stock and will be glad to show them to you. HYLUGS in Flip-Top boxes come in 29 popular sizes.

Items bought separately cost $11.45

price of Kit #11 complete with Y10M HYTOOL **$6.50**

BURNDY, Norwalk, Connect. or Toronto, Canada

BURNDY

58-8

Reader's Quiz

QUESTIONS from readers on problems of industrial equipment, installations, maintenance and repairs. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Static Voltage on Ungrounded Circuits

QUESTION P38—In our plant we have 220- and 440-volt, 3-phase delta ungrounded circuits for conveyors. These circuits have a static voltage that builds up to the circuit voltage on all three lines. What do you recommend to keep this static voltage off of the lines? It is harmless except when making tests on circuits when they are hot.—C.H.K.

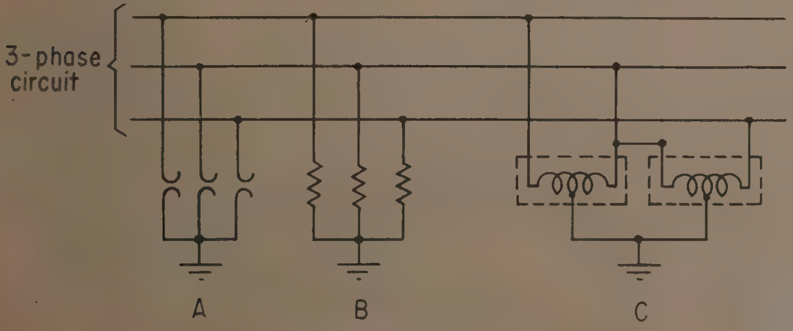
ANSWER TO P38—At such low voltages, static effects in the writer's experience have not been usual, and it is suggested an inspection be conducted to find and correct, if possible, the effects as described.

It is possible to apply corrective devices which can readily eliminate any effect to a tester. The diagram below indicates the remedies to be applied.

Application A includes the use of low-voltage vacuum-type lightning arresters which will discharge any excess static voltage at a low-increase value.

Application B includes resistors which will normally pass only a low current, less than 0.5 amps. This application has the advantage of continuous drainage.

Application C includes drainage coils of a type in common use in telephone circuits. It is even possible with this application to use a coil of this type without change. The type of circuit has an iron core which limits the normal current flow to a very low value due to the choking effect which passes only a magnetizing current. This application, as in "B" of the illustration, permits a continuous drain at normal voltage.



The questioner can choose any method for which material is readily available. For application "C" a laminated ring with a single winding having a midpoint tap can be readily constructed from standard coil parts.—C.O.D.

ANSWER TO P38—On a grounded system all the grounded metal items have a chance to blow a fuse if the insulation fails. Some switches and fuse blocks get a dust or liquid conductive film between the line and load screws. You can clean this film or use a 200-watt resistance load between the phases to remove this static charge. If the charge is dc, then it may come from a capacitor or from heavy conductors with good insulation acting as a capacitor. A resistor can drain the charge.—H.S.

Mounting Ballasts

QUESTION Q38—For a special fluorescent cove-lighting system, the ballasts should be located remote, on a wood wall. Can they be mounted directly on the wall, or do the ballasts have to be enclosed in a sheet steel box? How big should the box be to enclose two single-lamp ballasts? The lamps are 40-watt, rapid start, G.E. No. F40/WWX; the ballasts are G.E. No. 89G325, low power factor.—J.A.

ANSWER TO Q38—Section 410-74a of the NEC states that a ballast must not be in contact with combustible material. Article 410-75a states that auxiliary equipment shall be enclosed in metal cabinets, while paragraph c of the same section allows the use of ballasts approved for separate mounting without an additional enclosure.

You are probably familiar with the outdoor or weatherproof type ballast. This type has an integral junction box and requires no separate enclosure. If standard ballasts are to be used, a box is a must. A faulty ballast can get unbelievably hot, the compound will liquify and run out, and damage, possibly fire, may result.

Ballast boxes are available from several fixture manufacturers. I use a 14 by 14 by 4 hinged cover box as the enclosure. This has worked out well, with the ballast operating at a lower temperature than in the average fixture. The hinged door allows easy maintenance when required.—F.W.G.

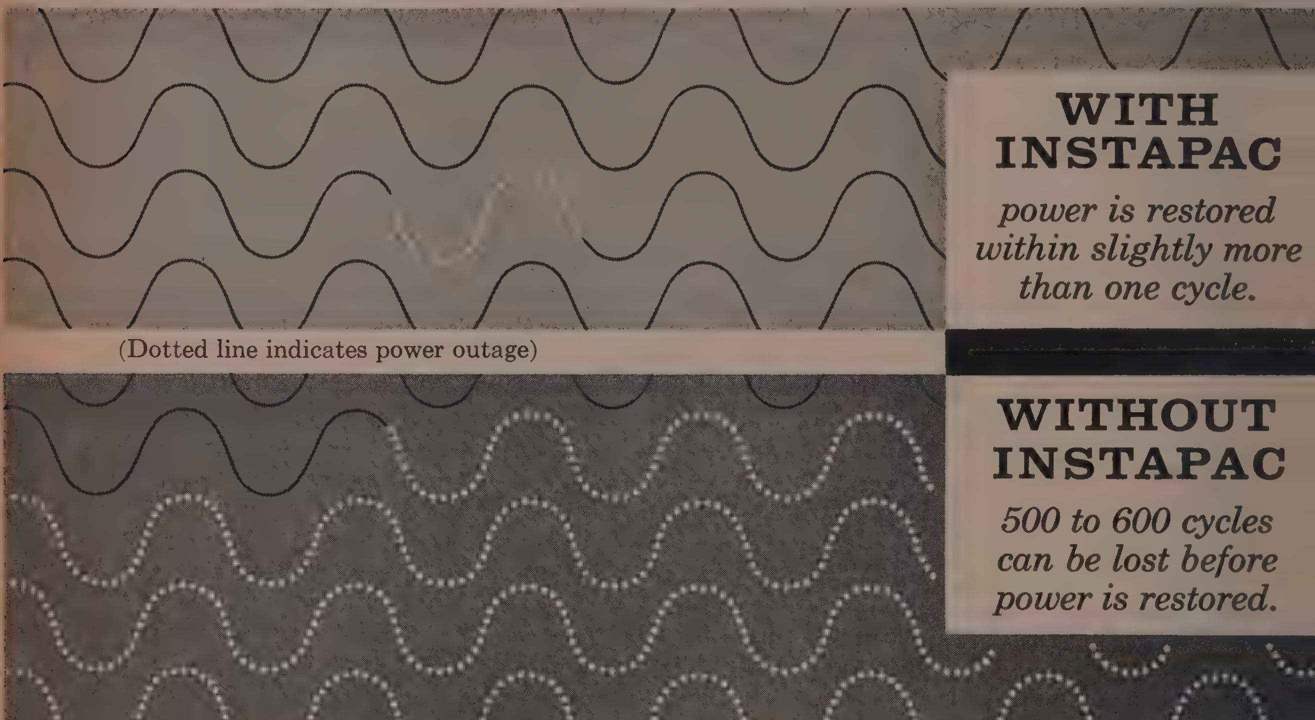
ANSWER TO Q38—The type of ballast mentioned in the question is designed for use in fixture or in a separate metal enclosure. According to the manufacturer's literature, the ballast is 1$\frac{1}{16}$ in. high, 2$\frac{3}{8}$ in. wide and 6$\frac{1}{2}$ in. long, and is used for a single, 40-watt rapid-start lamp.

Since these ballasts are not provided with a means for connecting branch-circuit or lamp conduits or cables, it is obvious that they must be installed in a metal enclosure of sufficient size to contain the ballasts, conductors, splices and conduit or cable connections. In addition, there must be sufficient air space to permit adequate dissipation of convection heat produced by the ballasts. A louvered cover would be helpful also. Moreover, the metal box should act as cooling fins to draw away ballast heat by conduction, provided that the ballasts are securely bolted to the box.

With these facts in mind, the metal box for the two ballasts in question should be at least 8 in. long, 6 in. wide, and 3 in. high. For optimum safety, place an insulating material between the wood wall and outside rear wall of the metal box, and be sure that the entire assembly will be located in an area that will permit adequate ventilation.

It should be remembered that a ballast is a heat-producing device,

Onan Instapac provides
your equipment won't know



WITH INSTAPAC

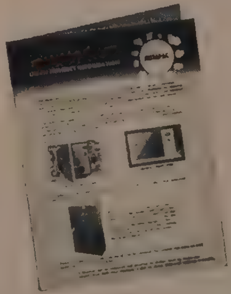
power is restored within slightly more than one cycle.

(Dotted line indicates power outage)

WITHOUT INSTAPAC

500 to 600 cycles can be lost before power is restored.

Write for free folder and specifications sheet



Complete data including diagrams showing three popular Instapac hook-ups: (1) Instapac combined with an Onan Standby Power Plant; (2) Instapac with no plant, using batteries for temporary standby power; (3) Instapac as a continuous power source for critical applications where not even the .020 seconds lapse in power can be permitted.

COMPACT SIZE. Wall Mounting: Cabinet (illustrated) 19″ wide, 30″ high, 8½″ deep. Rack Mounting: 19″ wide, 12¼″ high, 8½″ deep.

power so fast that
the main power is off

Within 20 milliseconds of a power outage, Instapac supplies emergency power . . . combined with an Onan Electric Plant you have complete standby protection

The seconds it takes to start an engine-driven standby power plant and switch it into the circuit may be too long where continuous operation is essential.

In microwave and television relay stations . . . in marine, railroad and aircraft communications . . . in telemetering . . . etc. . . . a power lapse of only seconds can jumble signals, cause wrong instructions to be sent, cause loss of valuable time, even loss of irreplaceable messages.

If you have any of these situations you need immediate power—you need Instapac.

Instapac is a transistorized inverter which converts battery current to alternating current of the proper frequency and voltage. It is rated at 1 KVA (a booster is available to raise this to 1.35 KVA) . . . 120 volts, 60 cycle; 50 cycle units also available. Instapac may be wall mounted, as illustrated, or rack mounted, to meet your requirements.

Instapac is reliable. There are no moving parts in the inverter itself such as you'll find in a motor-coupled, engine-driven standby plant where there's always the risk the engine won't start fast enough.

Instapac is manufactured by Onan, the world's leading builder of electric power plants—the only electric plants that are Performance Certified to do the job you want done . . . most dependably . . . and at lowest cost.

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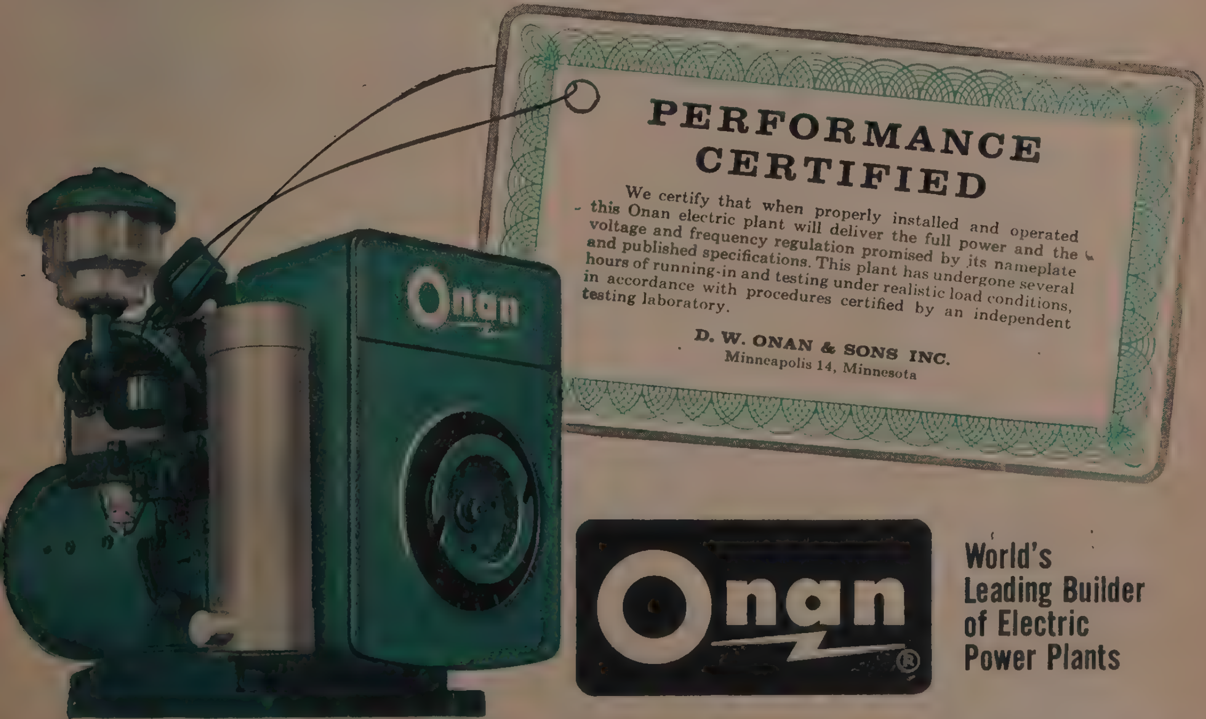

PERFORMANCE CERTIFIED

We certify that when properly installed and operated this Onan electric plant will deliver the full power and the voltage and frequency regulation promised by its nameplate and published specifications. This plant has undergone several hours of running-in and testing under realistic load conditions, in accordance with procedures certified by an independent testing laboratory.

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Power Plants

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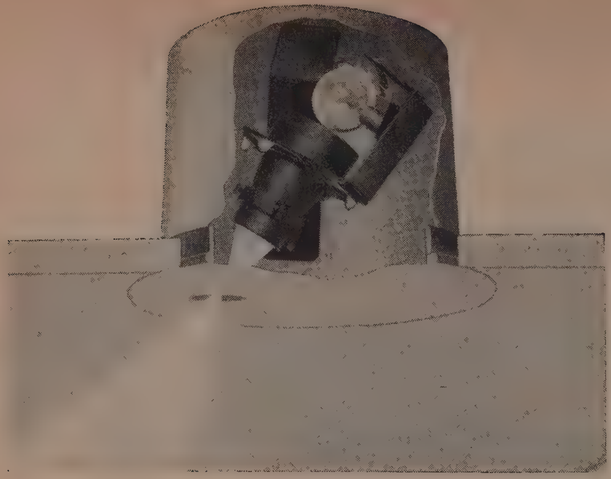

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Every feature of this outstanding Kliegl unit has been specifically designed to enhance and dramatize the natural beauty in a picture or other objets d'art.

Plan to use Kliegl Pinhole Downlights in your next project. In the meantime, for complete information, write for our Architectural Lighting Catalog.

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and as such, must be so installed that the rate of heat dissipation will equal or better the rate of heat accumulation. Otherwise, a short life is in store for the ballasts.

All these factors add up to the obvious conclusion that many difficulties can occur with such custom designs.

On the other hand, General Electric Co., as well as other manufacturers, offer standard enclosures or adapters for many of their standard ballasts. Such enclosures provide optimum heat radiation and cooler operating temperatures, being specifically designed for these two important factors. For best results, try to obtain enclosures from the manufacturer whenever possible.—J.W.

Voltage Variations

QUESTION R38—A feed mill is served with a 3-wire, 3-phase, 480-volt ungrounded type of service from a bank of three 50-kva transformers connected wye-delta with a floating neutral on the high side. Trouble developed such that the 3-phase, 440-volt motors would not run although the few small 115-volt single-phase motors and lights did work. They were served from a 440/110-volt single-phase dry-type transformer located in the building.

Voltage readings at the service disconnect switch were roughly 480 volts between all phases, except that when an attempt was made to start a 3-phase motor, one phase would drop to almost zero. The voltage readings to ground were extremely unbalanced, one phase wire to ground causing the voltmeter to slam against the peg on the 750-volt scale, and after several readings flashed over on the inside of the meter.

Continued investigation revealed that a terminal on the end of a coil on the low-voltage side of one of the 50-kva transformers had burned open inside of the transformer. This terminal was reconnected and everything went back to normal.

Where did the high voltage come from between one leg and ground that burned out the voltmeter?—R.B.F.

ANSWER TO R38—In any delta or ungrounded system the neutral point is theoretically at the center of a triangle with the line to neutral volts equal to the line-to-line value divided by the $\sqrt{3}$. This con-

SILICONE NEWS from Dow Corning

Now...Time for the Boys

Electrical Problems No Longer Short Circuit Our Family Fun

Sure, a father should be a pal to his sons . . . and, mine are at the age when they need and appreciate my companionship most. But when you're lucky enough to be employed at an assembly plant that's doubled capacity twice in the past eight years, you've got more than a full time job . . . and family activities frequently have to take a back seat.

During these eight years I've come up through maintenance to Assistant Plant Manager. It started when I suggested we replace certain troublesome motors with silicone insulated units. Then, when we doubled our plant the first time, I suggested we could double our electrical load capacity in the same floor space by using silicone insulated transformers. Just before our last expansion, my boss was made Plant Manager and I moved up to his assistant. He's taught me a lot . . . and I think I've helped him. We're a good team. And, for the first time since I started working, I'm finding time to really enjoy my boys. By the way, the car we're restoring is a Model A. No, not a Ford . . . a Dusenberg.

I think my progress is the result of plenty of hard work and a good eye for new and better ways of doing things. One of the most important things I've ever read was an advertisement on Dow Corning silicone insulation for electrical transformers and motors—just as you're doing now. I wrote for more information. Why don't you?

For brochure, "Specify Silicone
Insulation and Save",
Write Dept. 2812.

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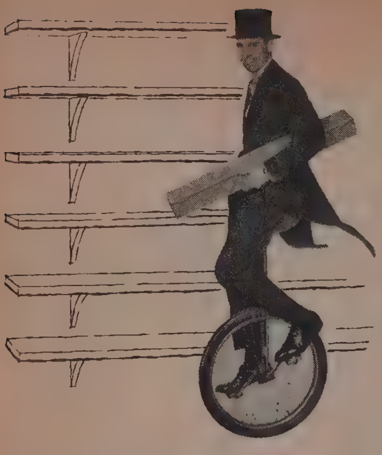

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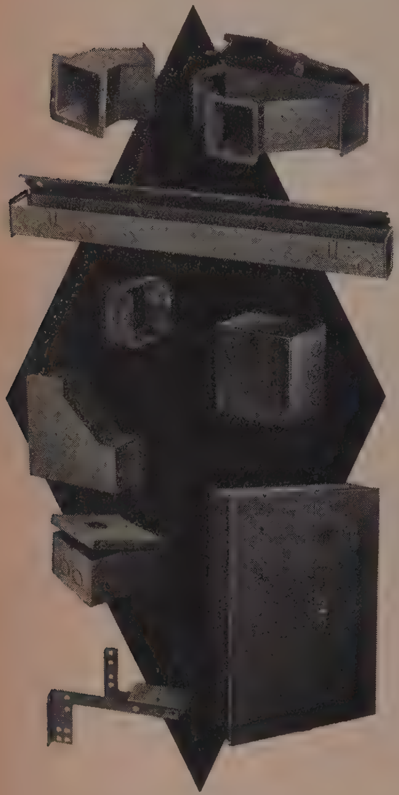

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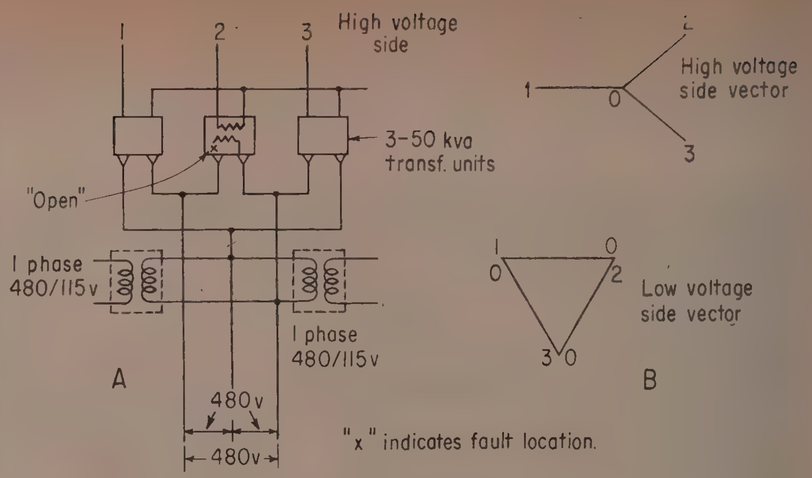

dition is rarely if ever found in actual practice hence the reason for grounding the neutral of the star-connected side solidly to ground or through a resistor to maintain a fixed value.

For the case under consideration the break "X" as indicated in A and B above totaled an induced voltage of theoretically 480 × $\sqrt{3}$ or 831.4 volts which approximates the off-scale voltmeter reading of 750 volts.—C.O.D.

ANSWER TO R38—If a high voltage lead gets grounded and a second high voltage lead touched the secondary winding through a high resistance path, then your high resistance voltmeter will read most if not the total primary voltage. The 3-phase motors could not start on single phase, and the high-resistance primary path could not deliver a high enough voltage to burn out a motor. The motors were disconnected when you connected the high-resistance voltmeter, so the voltmeter burned out. When you repaired the transformer, you also removed the high-voltage connection to the ground and one secondary lead.—H.S.

Encapsulated Winding Repairs

QUESTION S38—We have been told that motors that have epoxy encapsulated windings cannot be stripped for rewinding in case of winding failure. If this is the case, then how are these motors rewound? We would greatly appreciate any discussion on this subject, as we now have many motors with epoxy encapsulated windings and are in the throes of purchasing more.—J.A.M.

ANSWER TO S38—The use of epoxy encapsulated motors, in place of totally enclosed fan cooled motors, should be encouraged, due to their superior performance. The rewinding of the motors presents no problem. Every major city now has authorized encapsulated motor repair service centers. They are fully equipped with necessary molds and the know how to repair all the popular sizes at an economical price.

Most manufacturers offer an attractive stator exchange plan that should take care of encapsulated motor users, located in remote areas.

I would like to suggest that J.A.M. contact his choice of manufacturer for their recommendations, as to motor-repair service available. —H.E.H.

ANSWER TO S38—The epoxy encapsulated windings will not burn out in spots where other motors will burn out. Since the epoxy formula changes sometimes, I would suggest checking with the manufacturer of a specific motor for his recommendations as to the feasibility of rewinding or if a stator exchange program is available.—H.S.

CAN YOU ANSWER These QUESTIONS?

QUESTION Z38—With increasing distance and output forcing our hand, plus the ever increasing cost of manpower, we are obligated to operate two mine locomotives per train.

It is hoped that some readers with experience in this matter can assist in making a decision as to the type of control best suited to this ganged-up type of traction. Drum-type controllers will be eliminated for line current for either the semi-magnetic control or the full magnetic control. With the former, contactors are used to start, accelerate and stop the train. The reconditioned drum controllers will handle only the coil current to the contactors, while the interlocked reversing drum will maintain full line current.

With the full magnetic control all the functions are achieved magnetically, either by all contactors or by contactors and a magnetic reverser. With this method we gain not only the start, acceleration, deceleration and stopping features, but also reversing the series and parallel connections, plus dynamic braking and tandem operation. We plan to wire the units to either reverse or forward contactors or magnetic reverser by a small control cylinder as a replacement for the old reverse drum in the present set-up. The circuit through these contactors or magnetic reverser will not be closed until the cylinder is moved one step for acceleration, thus removing heavy currents from the controller and saving greatly on copper costs. With this plan only jumpers need be coupled between units if two trolley collectors are used. But, is the latter a good practice?—H.O.

QUESTION A39—Can anyone tell me where you can buy silvered contacts in the form of a rivet to be used as replacement contacts to timers, relays, starting switches, etc.?—L.R.S.

QUESTION B39—Why is one half line voltage obtained between 50% taps on a delta connected 3-phase transformer, when there are the same number of turns between the 50% taps as between the full voltage terminals?—G.J.P.

QUESTION C39—We recently experienced a failure on our switchgear control batteries. Visual indications revealed what appeared to be an internal explosion of one battery. If it was an explosion, what caused it? If not, then what could have happened that would appear as if an explosion had taken place?—J.A.M.

PLEASE SEND IN YOUR ANSWERS BY JANUARY 15

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For your every portable cord and cable need there's a Bronco 66 Certified product . . . Heavy Duty Type SO Cords, Heavy Duty Type W, and G (with ground wires) Cables, 300 volt Type SJO Cords, Type SO cords and cables specially engineered for use on payout and retractable reels, Control Cables High Voltage Cables for 3 KV and 5 KV service, Welding Cables, Motor Lead Wires . : . They're all work-savers because they're so flexible; time-savers because they're so dependable.

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WESTERN INSULATED WIRE COMPANY
Los Angeles 58, California

Questions on the Code

Answered by:

B. A. McDONALD, *New York Board of Fire Underwriters, Rochester, N. Y.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*
R. E. WARD, *Chief Electrical Inspector, Insurance Department, State of Tennessee, Nashville, Tenn.*

Service Switches

Q. *Please tell us if code rules are violated under the following:*

Service, 115/230 volts, 3-phase delta, metering outside.

A 3-pole main switch, serving all 3-phase and 220-volt equipment with service wires to outside.

Separate main switch, 3- wire SN, serving lighting load with separate entrance wires to outside and connected on same metered service drop.

No cross connection between the two main switches.

Both switches at same location. See sketch below. O.M.R.

A. My interpretation of your question is that there is no violation in the NEC, and I base my opinion on Section 230-2 Exception No. 6, which reads:

"Exception No. 6: Different Characteristics or Classes of Use. Where additional services are required for different voltages, frequency, or phase, or different classes of use. Different classes of use could be because of needs for different characteristics, or because of rate schedule as in the case of controlled water heater service."

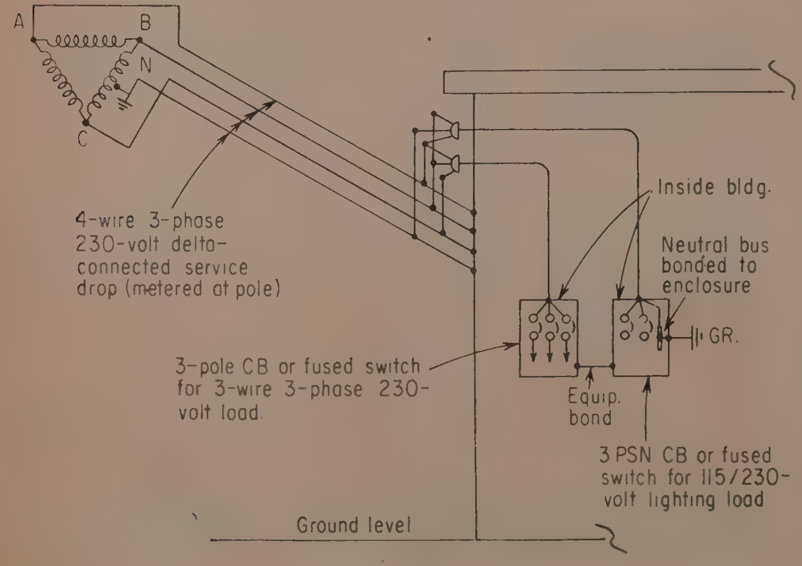
This section concerns the number of services to a building, which states in general a building shall be supplied through only one set of service conductors with exceptions, and I have quoted one of the exceptions.

According to your statement I would certainly class this installation as a different class of use.

Therefore, you could have more than one set of service conductors.

Moreover, such an installation as you describe is common practice in many areas.

Each switch in such an installation should have a permanent marking giving the load it serves.—R.E.W.—12/60/1


A
B
N
C
4-wire 3-phase 230-volt delta-connected service drop (metered at pole)
Inside bldg.
Neutral bus bonded to enclosure
GR.
3-pole CB or fused switch for 3-wire 3-phase 230-volt load
Equip. bond
3 PSN CB or fused switch for 115/230-volt lighting load
Ground level

Computing Receptacle Load—Branch Circuits

Q. *When calculating the branch circuit loading for lighting in a store occupancy, does the 3 watts per sq ft in Table 220-2 (a) take care of the receptacles installed for illumination?—R. L.*

A. The fine print note following Table 220-2(a) advises as follows:

"All receptacle outlets of 15-amp or less rating in single-family and multi-family dwellings and in guest rooms of hotels (except those connected to the receptacle circuits specified in Paragraph 220-3(b) may be considered as outlets for general illumination, and no additional load need be included for such outlets. The provisions of Paragraph 220-2(b) shall apply to all other receptacle outlets."

It appears evident from the foregoing that the normal receptacles installed in a dwelling occupancy or guest rooms of hotels are considered to be used for fixed lighting, portable lighting fixtures or small appliances common to such occupancies. As a result, the 3 watts per sq ft is considered to be adequate when computing the branch-circuit or feeder load. It is significant to note, however, that all other types of occupancies are excluded. Therefore, the receptacles installed in a store occupancy would be subject to the minimum 1½-amp provisions of Section 220-2(b). The fine print note following this section makes an exception for "receptacle outlets provided for the connection of fixed lighting units to facilitate servicing and replacement." An example of this exception covers the situation which prevails when ceiling fluorescent fixtures are connected to the circuit by means of a cord and receptacle. Such fixtures are considered to be fixed in place regardless of the cord connection, and would be covered by the 3 watts per sq ft provision. The occasion for the distinction, on the basis of occupancy, appears to be justified when we consider the nature of the various loads which may be connected to receptacles installed in some of our stores—signs, coolers, large fans, etc. When a receptacle is available, such appliances are often connected indiscriminately with little regard for the rated capacity of the circuit. The 1½-amp provision would limit the number of receptacles on a 15-amp branch circuit to ten. When loads other than fixed lighting fixtures are connected to such receptacles, the 1.5 amp provision minimizes the occasion for overloading the circuit.

A brief summary of the foregoing indicates to me that the 3 watts per sq ft in Table 220-2(a) does not take care of the receptacles installed in a store occupancy, outside of exception cited.—B. A. McD.—12/60/2

Only ALLEN-BRADLEY LIMIT SWITCHES FINISHED TEST with *NO FAILURES!*

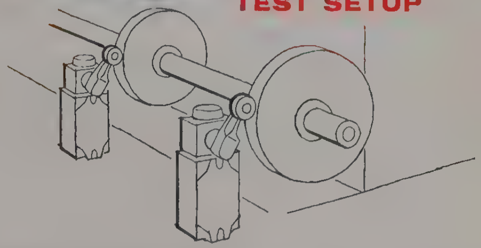
. . . and remained good for many more millions of trouble free operations

Recently, a large user of limit switches selected two identical units from each of five leading manufacturers and subjected them to the same accelerated life test. When the test was stopped after many, many millions of operations, only Allen-Bradley Bulletin 802T oiltight limit switches were left *with no failures!* Also, a careful inspection of these two Bulletin 802T limit switches suggested that they were still good for *many more millions* of operations.

The Allen-Bradley "built-in" quality is the reason for such unmatched performance. With switch bodies and operating heads positively sealed against oil and dirt, A-B Bulletin 802T limit switches are free from contact fouling and sluggish operation. The precision switch mechanism has a positive snap action—it is impossible for vibration to cause contact chatter. The double break, silver contacts never need servicing.

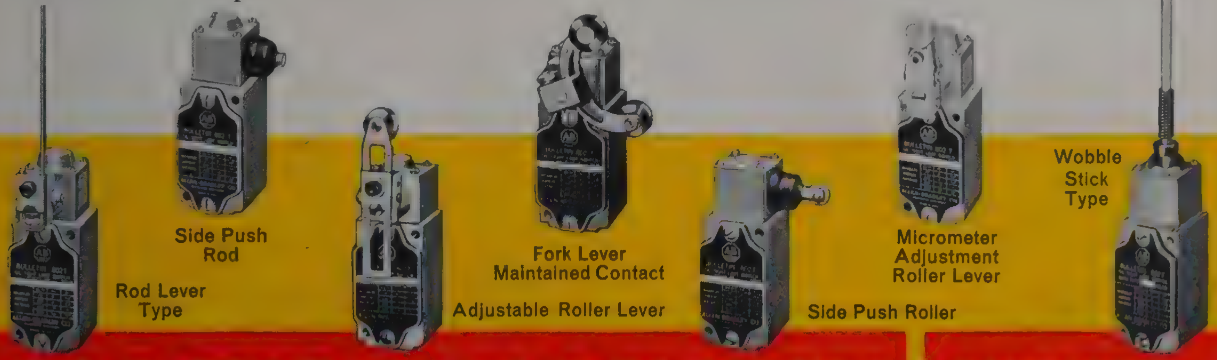
Insist on Allen-Bradley Bulletin 802T oiltight limit switches—they will *always* provide you with the long, trouble free life that is so important to continuous production. Send for details on the complete A-B limit switch line.

TEST SETUP



Purchased through regular supply channels . . .

and tested under identical conditions, insuring an impartial evaluation of performance. Of the ten limit switches tested (two each of five different makes), only three were operating when the test was stopped. Two were A-B Bulletin 802T switches and one of another make, of which the second unit had failed early in the test. On this accelerated life test, one unit switched 1.0 ma at 115 v dc while the other unit switched 10 ma at 115 v dc.



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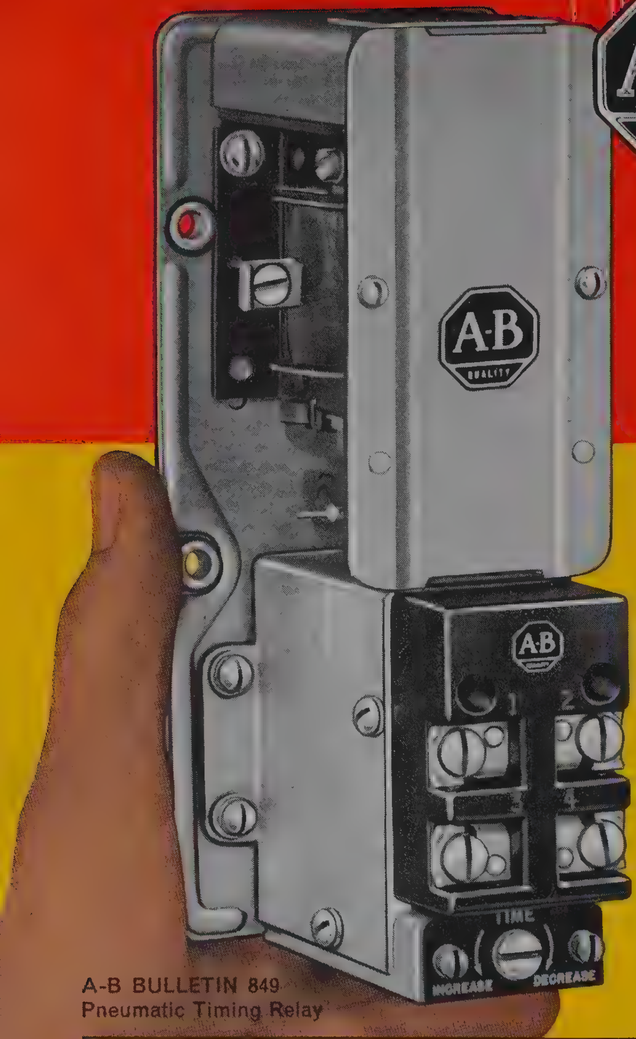


A-B BULLETIN 849
Pneumatic Timing Relay

For Consistent Accuracy...

Specify

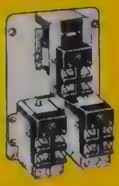
ALLEN-BRADLEY TIME DELAY RELAYS

For maximum production, high-speed automatic processes demand that the required operations "start" and "stop" at the correct instant, time after time—*without variation.* For consistent accuracy and trouble free operation, no timing relay on the market can equal the performance of A-B Bulletin 849 pneumatic timers. The delay period can be varied from 1/20 of a second to 3 minutes, and the setting will hold with an accuracy of ± 10%. Conversion from ON-DELAY to OFF-DELAY (or vice versa) is simple—no adjustment is necessary. Like *all* A-B control, these quality timers have maintenance free, double break, silver contacts. The two sets of contacts—one N.O. and one N.C.—are electrically independent, for greater control flexibility. Also, auxiliary contacts can be easily added.

To make certain of a completely satisfactory electrical installation, specify Allen-Bradley "quality motor control"—in addition to the Bulletin 849 pneumatic timing relays. Write for details, today.

A few of the varieties of A-B pneumatic timers

Single operation time delay relay



Dual operation time delay relay

Compound operation time delay relay

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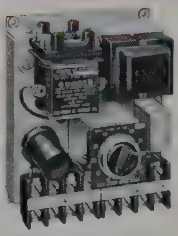
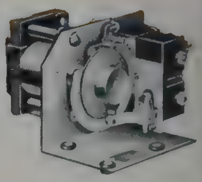
Fluid Dashpot
Timing Relay



BULLETIN 852
Electronic
Timing Relay



BULLETIN 850
Motor Driven
Process Timer

32-60-RM

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Derating Factors-Motor Branch Circuits

Q. *We have received diverse opinions as to the intent of the code.*

An example would be—if the branch circuit conductors of two 5-hp 3-phase, 220-volt motors were pulled in the same conduit from the branch-circuit switches to the starters. The motor conductors are originally derated to 80% of full load by increasing the motor load to 125%. (Example: 15 amps × 1.25 = 18.75 amps or No. 12 wire.) Is it now necessary to derate the conductors again by 80% because six of them are pulled in the same conduit? (Example: 18.75 ÷ .80 = 23.4 amp wire or No. 10)

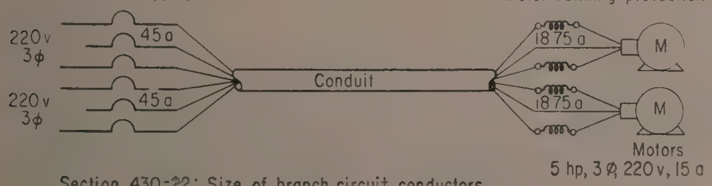
If four 5-hp motor circuits were placed in a conduit would the procedure, because of the 12 wires, be—15 amp × 1.25 = 18.75—load per 5-hp motor—and because of 12 wires. 18.75 ÷ .70 = 26.8 amp wire or No. 10's. Or would it only be necessary to derate the original 15-amp motor load by 70%—15 ÷ .70 = 21.4 amps or No. 10 wire?

All motor loads are to be increased by 125% when calculating wire gauge. What is the reasoning behind this procedure—because of the possibility of the motor running for long periods of time; or that the motor is wound so that it may be loaded to 125%, therefore, the wire feeding the motor will be 125% wire?—W.A.H.

A. In the interest of clarity, the illustration shown covers the circumstances involved with your first problem. According to Section 430-22, the branch-circuit conductors supplying a single motor are required to have a current-carrying capacity of not less than 125% of the motor full-load current rating. There are exceptions to this fundamental rule as covered by Table 430-22, which covers the nature of the duty for which the motor is designed. Motors may be overloaded due to poor maintenance or the method of operation. Usually motors are designed to carry a 50% overload for a specified period of time. As a result, the motor-running protective device may be set at 125% or 115% of the full-load current rating of the motor depending upon the type of motor involved (Section 430-32). As shown by the diagram, the motor-branch-circuit conductors for a 5-hp, 15-amp motor may be protected by an overcurrent device rated at 45 amps, but the motor winding is protected by an overcurrent device rated at 18.75 amps. This combination protects the conductors from gradual overloading on the basis of the 125% rating of the motor-running protective device. If the conductors were not required to have a current-carrying capacity not less than 125% of the full-load current rating of the motor, they would not be adequately protected. In other words, the conductors are sized so that they will be adequately protected against gradual overload by the motor overcurrent protective device. The motor-branch-circuit conductors are considered to be protected from short circuit by the overcurrent devices protecting such circuit conductors. In view of the foregoing, the occasion for this code rule is in no way concerned with the number of conductors in a conduit.

Note 8, Table 310-12 covers reduction factors which must be applied when more than three conductors are installed in a conduit or cable. In the case under discussion each of the six No. 12 conductors installed in a conduit would have a current-carrying capacity of 80% of 20 amps, which is 16 amps. The occasion for this rule concerns the conductor heat losses due to the flow of current. Since such heat loss will increase in proportion to the number of conductors involved, extensive tests have proven the fact that the current-carrying capacity of conductors must be reduced in proportion, so that excessive heating will not deteriorate the conductor insulation.

In order to satisfy both of these objectives it appears, on the basis of a literal interpretation of the code, that both rules must be applied as shown by your computations. On the basis of logic, such an interpretation could be questioned in view of the current rating of the motors and the 20-amp current-carrying capacity of a No. 12 conductor. As shown in the drawing, the provisions of Section 430-22 are satisfied by the use of a No. 12 conductor. The provisions of Note 8 reduce the carrying capacity of a No. 12 conductor from 20 to 16 amps. This is 1-amp more than the 15-amp full-load rating of the motor. In other words, six No. 12 conductors, each carrying 16 amps, and installed in a conduit would not generate sufficient heat to damage the conductor insulation. Under such circumstances both of the two motors would simultaneously be operating at a 7% overload. Under such a combination of circumstances, it appears that the occasion to require No. 10 conductors is questionable. On the basis of the 125% motor overcurrent protection, all of the conductors could carry 18.75 amps. Under such circumstances the motor would be subject to a 25% overload. Under such circumstances, the six conductors could generate enough heat to damage the conductor insulation. Since code rules are based on minimum provisions considered necessary for safety, one might question the occasion to use No. 10 conductors on the premise that both motors would not operate, continuously and simultaneously, at a 25% overload. In support of this opinion it appears obvious that any excessive heat generated in the six conductors will be conducted to the motor overcurrent devices and implement their operation.



Section 430-22: Size of branch circuit conductors
15 amps x 125% = 18.75 amps No. 12 conductors
1" conduit or 2-½" conduits
Note 8, Table 310-12: 6 conductors in a conduit.
Current-carrying capacity of No. 12 = 20 a x 80% = 16 amps

Size of conductors: 18.75 ÷ .80 = 23.4 amps No. 10 - 1" conduit required

In the case of the four 5-hp motors, we would have 12 conductors in a conduit, and their current capacity would be derated to 70%. As a result, a No. 12 conductor would be rated 70% of 20 amps which gives a 14-amp capacity. This of course is less than the 15-amp full-load current rating of the motor. A No. 10 conductor would have a 21-amp rating, and such a rating would satisfy the provisions of Section 430-22 and also note No. 8, Table 310-12. This example shows how the picture changes as the variables enter same.

While a literal reading of the rules indicates that both must be

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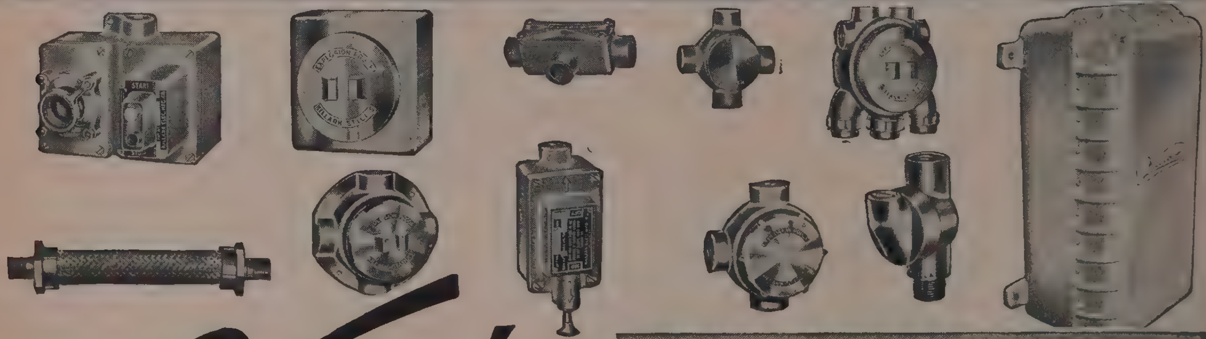

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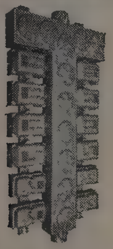
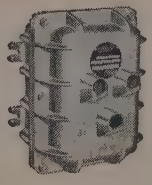
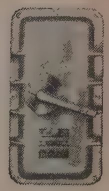


PANEL BOARDS

CIRCUIT BREAKERS



MOTOR STARTERS



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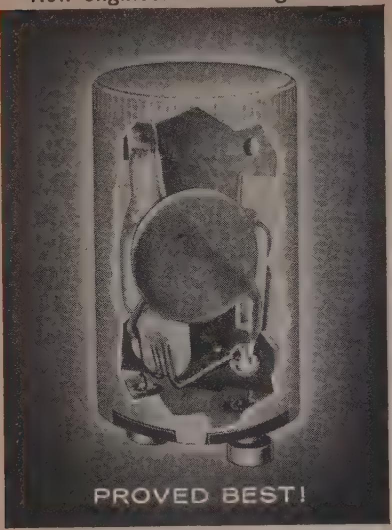

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applied, the foregoing logic leads one to believe that when six wires or less are involved, the occasion for the application of both rules is questionable. When more than six conductors are involved both rules must be applied. This personal opinion is given on the basis of minimum code requirements with no consideration for voltage drop. —B.A.McD.—12/60/3

Conductor Clearances

Q. *There seems to be some conflict in Section 230-26 and Section* 730-18, *paragraphs* (*a*) *and* (*b*) *for ground clearances for outside wiring over certain establishments.*

Please give your answer to this conflict in the National Electrical Code.—J.S.F.

A. Article 230 deals with services. Section 230-26 concerns the point of attachment to buildings with minimum heights for service drop conductors and this requirement is 10 ft above sidewalks, 18 ft above driveways, alleys and public roads. Section 730-18 deals with outside wiring and not service drops. Section 730-18 concerns outside branch circuits and feeders; and as you know, outside branch circuits and feeders would require overcurrent protection other than would be required for a service drop running from the power company's transformer.

Also notice that the title of Article 730 is "Outside Branch Circuits and Feeders," and these terms are properly defined in Article 100. R.E.W.—12/60/4

Readers Comment

The following letter received from Russ Linton of San Diego, Calif., is appreciated since it directs our attention to a false concept of voltage drop when conductors in multiple are used:

"In the September issue Questions on the Code, item 9/60/15, you made the statement the improperly paralleled conductors could lead to excessive voltage drop. While I am not at all advocating improper division of current in such conductors, due to sloppy cutting or use of different gauges, your statement about voltage drop is not true. By definition, paralleled conductors would have the same potential difference impressed. One or more conductors too short or too long will lower or raise the effective resistance of the combination, the effect being diluted by the remainder of properly cut cables."

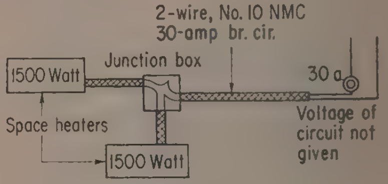
In support of his contention, Mr. Linton, by the use of pertinent formulas, demonstrates the fallacy expressed. This may be verified by application of published voltage drop tables. As an example, a 500 MCM conductor carrying 275 amps 3-phase for a distance of 100 ft, has a voltage drop of 1.29 volts. When two such conductors of equal length and terminal resistance are used in multiple and each subject to 275 amps, the voltage drop would be 2.58 volts.

When one 500 MCM conductor carries 300 amps and the other 250, the voltage drop over the combination would be the same, 2.58 volts. When one conductor carries the entire load of 550 amps, the voltage drop would be 2.58 volts. Computation at 100% power factor. The voltage drop increases with lower power factor loads.

Errors of this nature make one feel the humility of his imperfections. Thoughts conceived in haste often make waste. Thanks for taking time out to call the matter to my attention.—B.A.McD.—12/60/5

Heating Appliances on 30-Amp Circuit

Q. *Can two space heaters,* 1500 *watts, be connected to one,* 2-*wire, No.* 10 *Romex circuit from one junction box on one pair* 30-*amp plug fuses? (See diagram.) Most of the electrical contractors say it is O.K. I am not convinced it is.—J.E.R.*



3000 watts at 230 volts = 13 amps.
3000 watts at 115 volts = 26 amps.
Current capacity No. 10 = 30 amps.
Current capacity No. 10 derated 80% = 24 amps.

A. The provisions of Section 210-24 of the code indicate that the above described procedure is in compliance with this rule which is quoted as follows:

"Section 210-24. Permissible Loads on Branch Circuits.

"Paragraph (b). 30-Amp Branch Circuits. Fixed lighting units with heavy duty lampholders in other than dwelling occupancies; or appliances in any occupancy. The rating

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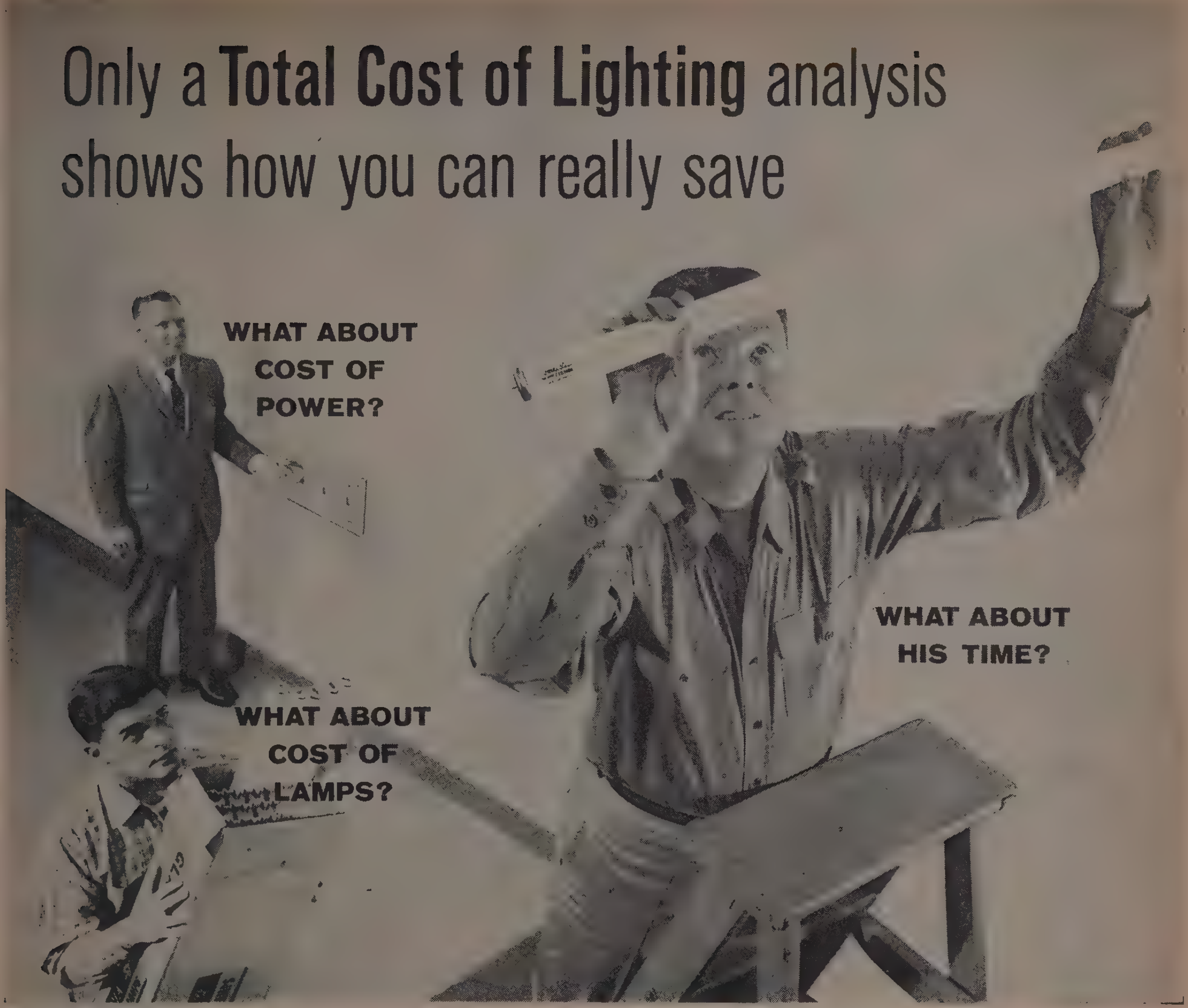
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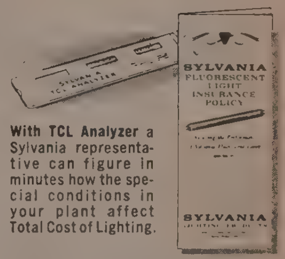

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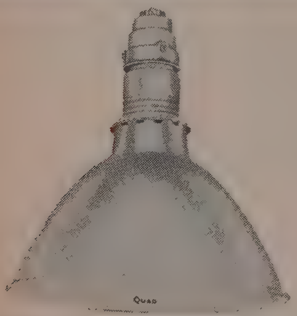

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of any one portable appliance shall not exceed 24 amps."

Since you do not specifically cover the voltage of the circuit further comment appears to be in order. If the 2-wire circuit operates at 230 volts, the total connected load would be 3000 watts divided by 230, or 13 amps. In this case there is no question with respect to the size of the No. 10 conductors but the provisions of Section 210-6(b) enter the picture. This section of the code limits the voltage between conductors in a dwelling occupancy to 150 volts. There are three exceptions to this general provision and it appears evident that your 1500-watt heating appliances, either permanently installed or portable come within the exceptions and may be connected to a circuit whose conductors operate at 230 volts.

If the 2-wire circuit operates at 115 volts, the total connected load would be 26 amps and the provisions of Section 210-23 could enter the picture. Paragraph (b) of this Section advises that the total load on a 30-amp branch circuit shall not exceed 80% of the circuit rating when in normal operation the load will continue for long periods of time. While the code does not define long periods of time, Code Making Panel No. 8 suggested a revision of the 1956 Code that would definitely define such periods as three hours or more. This proposal was not accepted as evidenced by the 1959 Code. 80% of a 30-amp branch circuit derates its loading to 24 amps. If these heating units are, in the judgment of the inspection authority, to be used for long periods of time, two of them could not be served by a 2-wire, 115-volt, 30-amp circuit. When all factors are considered, the logical answer would be to use a 3-wire, 115/230-volt, No. 12 branch circuit.—B.A.McD.—12/60/6

Number of Wires in Boxes

Q. *Non-metallic sheathed cable is the wiring method. The cable contains a bare grounding wire.*

In computing size of outlet boxes and number of conductors allowed in such boxes, how do you count the bare grounding wires?—M.L.

A. Your question is not clearly answered in Article 370, Section 370-6 of the 1959 NEC, which states in part as follows:

"Boxes shall be of sufficient size to provide free space for all conductors enclosed in the box."

Exceptions are made in the section for fixture wires, fixture studs, cable clamps and hickeys. Switches and other items are stated but nothing is said about bare wires used for grounding purposes. From reading the Canadian Electrical Code, 1958 edition, and the supplement to this same code dated 1959, I am sure your question has arisen in Canada and has been clarified in the 1959 supplement of their code. First, I quote from the 1958 Code, Rule 12—292:

"12-292 Number of Conductors in a Box. Subject to the provisions of Rule 12-296, each conductor running through or terminating in an outlet box or junction box shall have at least the amount of free space within the box specified in Table 22 for conductors of its size, and the total number of conductors which may be run through or terminate in a box shall be limited accordingly."

Rule 12-296 is as follows:

"12-296 Maximum Conductors in a Box Containing Fixture Studs, Etc. (1) Where outlet boxes and junction boxes contain fixture studs, cable clamps, hickeys, switches, receptacles, or other fittings or devices, the maximum number of conductors which shall be contained therein shall be one less than is specified in Tables 22 and 23 and the maximum number shall be further reduced by one for each flush device or combination of flush devices mounted on the same strap."

The 1959 rule 12-292 covers old rules 12-292 and 296 which is as follows:

"12-292 Maximum Number of Conductors in a Box.

(1) Boxes shall be of sufficient size to provide usable space for all conductors enclosed in the box.

(2) The total number of insulated conductors which may run through an outlet, flush device, or junction box unbroken or which may originate outside and terminate in such boxes, or both, shall be limited in accordance with Subrules (3), (4), (5), and (6) as applicable.

(3) Subject to the provisions of Sub-rules (5) and (6), boxes of the nominal dimensions shown in Table 23 shall not contain more insulated conductors of the sizes shown than are specified therein.

(4) Subject to the provision of Sub-rules (5) and (6), boxes having nominal dimensions not shown

in Table 23 shall have at least the amount of usable space within the box specified in Table 22 for insulated conductors of a given size.

(5) Where the boxes contain fittings or devices such as fixture studs, cable clamps, or hickeys, the maximum number of conductors contained therein shall be one less than is specified in Sub-rules (3) and (4) and the maximum number shall be further reduced by one for each flush device or combination of flush devices mounted on the same strap.

(6) Where single flush boxes are ganged and each section thereof is occupied by a flush device or combination of flush devices mounted on the same strap, each section shall be deemed to be a separate box."

Along this same subject, the Canadian Rule 12-108 states:

"12-108 Provision for Grounding.

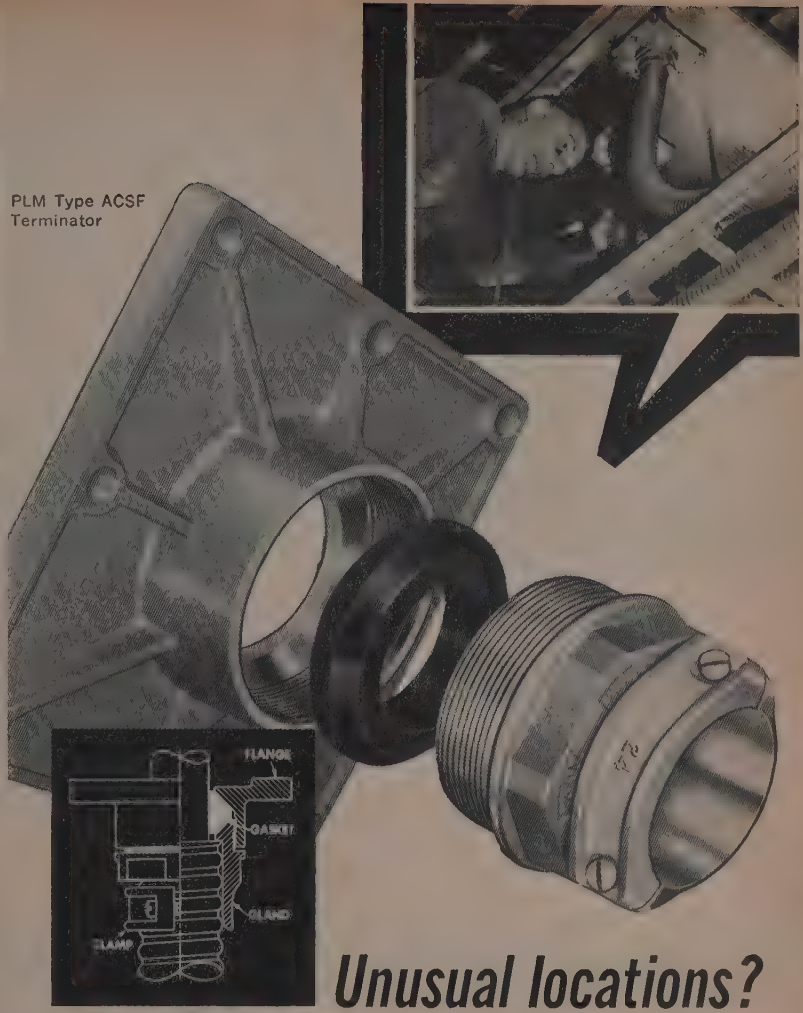
(1) The cable shall contain a grounding conductor.

(2) The grounding conductor shall be secured to every metallic box by means of a grounding screw, which shall be used for no other purpose.

(3) The grounding conductor shall be brought into every non-metallic outlet box in such a manner that it can be connected to any fitting or device which may require grounding.

(4) Where more than one grounding conductor enters a box, all such conductors shall be in good electrical contact with each other by means of securing all grounding conductors under grounding screws, or by connecting them together with an acceptable solderless connector and connecting one conductor only to the box by a grounding screw or an approved grounding device, and the arrangement shall be such that the disconnection or removal of a receptacle, fixture, or other device fed from the box, will not interfere with or interrupt the ground continuity."

As previously stated, your question is not clearly answered in the National Electrical Code; however, I am in agreement with the wording of the Canadian Code in counting only the insulated conductors. In comparing Tables 22 and 23 of the Canadian Code with Table 370-6-(A1) of the National Electrical Code, I find the Canadian Code in some instances will allow one more conductor in a box than is allowed by the National Electrical Code. However, in most instances the number of conductors allowed is the same.—R.E.W.—12/60/7



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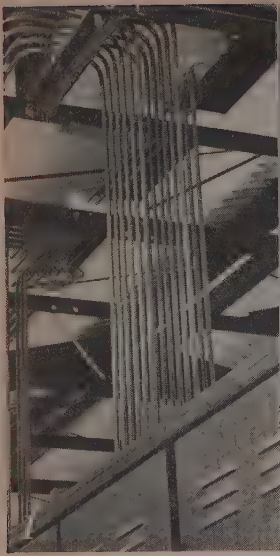

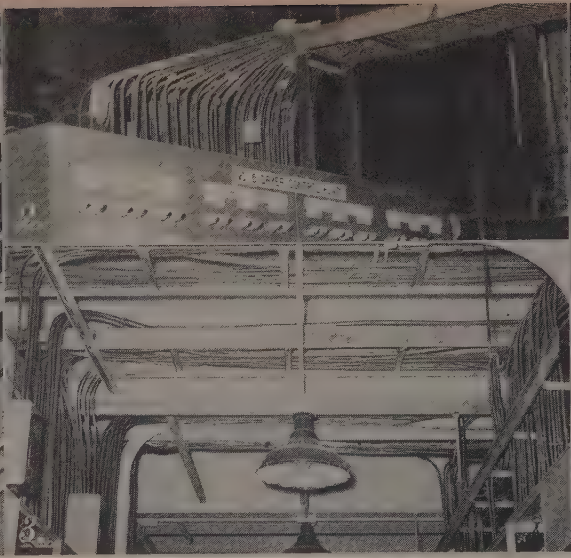

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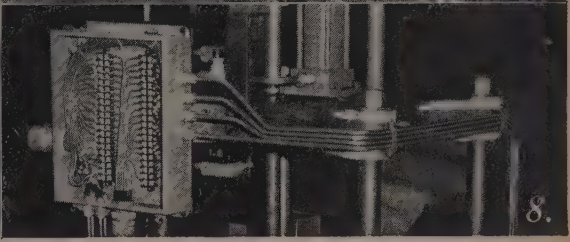
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8. Use flimsy radiators. Trouble with radiators is they stick out like bat wings. Flimsy construction would cut costs. But damage could suddenly become a big, expensive problem.

9. Cut down on the finish. This would just cost you more in frequent repainting. I-T-E shot blasts inside and out. Applies one prime coat and two finish coats. Keeps rust out.

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NECA Convenes in Las Vegas

Expansion of the market for electrical contractors' services seen as major goal as industry looks to continued high level of business activity.

A RECORD convention of the National Electrical Contractors Association was housed along the fabulous "strip" and conducted at the spanking new Convention Hall in Las Vegas, Nevada, from October 23 to 28. Members and guests attending the meetings, the trade show and the social functions were estimated at nearly 5000.

President Harold A. Webster keynoted a business program reflecting generally a strongly optimistic outlook for electrical construction and a rising demand for the goods and services of the electrical contractor. On the controversial missile base program he said that prompt and aggressive action by the construction industry appears to have stopped the move to keep independent contractors from participating in the missile base program.

Discussing trends in the building industry, Mr. Webster described the attempt by large airframe and electronic manufacturers to do all the construction at the missile sites as the "greatest challenge to the construction industry since it emerged as an independent entity." As a result of construction industry action, he said, there is every indication that the missile program will use construction contractors and skilled construction workers as much as possible.

"The important business opportunities for electrical contractors in the field of maintenance by contract have been advanced materially by the joint action of labor and management through the Construction Industry Joint Conference," Mr. Webster said. "This is an area where contractors can maintain an even flow of business irrespective of the ups and downs of the new construction market."

Mr. Webster took note of a rising demand from the construction industry for a higher plane of ethical conduct.

"Through the Council we have helped develop procedures designed to reduce one focal point of infection of our business morality in the area of bid shopping and bid peddling," he said. "Remarkable progress has been made this past year in this regard. Sentiment has swung from a 'it-can't-be-done' attitude to actual fair bidding procedure programs being underway in more than a score of cities."

Mr. Webster was optimistic about the business outlook for electrical construction. Electrical expansion will continue to double each decade for the next 20 years at least, he said. Since every additional kilowatt of use requires electrical contractor services, the outlook for the industry is exceedingly good. However, he warned: "Unless we aggressively promote ourselves as sales agents for all electrical construction material and equipment requirements, we will lose much of the financial benefits of this growth, and fail in our obligation to the customer of construction services to provide expert guidance for the economical, safe and efficient use of electricity."

William M. Ridmann, Ridmann Electric Co., and Joseph A. Pope, Beltzhoover Electric Co., both from Cincinnati, Ohio.

He said that since electrical construction is not seriously affected by the housing slump this year, the volume of electrical contracting not only is holding up well but is showing substantial gains. The fact that over-all construction markets appear to be leveling out does not mean that the electrical contracting market in construction will be only sidewise. Industry is investing a larger percentage of its plant and equipment money in modernization, particularly electrical modernization, and a lesser amount in new plants. That holds promise for continuation indefinitely of a high level of electrical contracting, Mr. Webster concluded.

Paul M. Geary, executive vice president of NECA, reviewed the Association's organization and operating structure.

Mr. Geary said that contractors are concerned over profits, or lack of them. "Construction volume has held at a high level for many years yet profits have dwindled to the vanishing point. One reason for this is the lack of appreciation by the contractors of the need to keep in balance their sales, their finance and their production. When those are in balance there is a good opportunity for profit. Thus, our theme: Sales plus Finance plus Production equal Profits. There are some intangible factors that have a great effect on profits, particularly the ethical standards and the moral climate of conducting business."

Business morality was the subject of the keynote address the

Elwood C. Peele, Peele Electrical Co., Burlington, N. C., received the Coggeshall Award.

Ernest R. Edenfield, Edenfield Electric Co., Nashville, Tenn., received the Comstock Award.

Denis J. Crimmins, manager, New York City Chapter, NECA, received the McGraw Award.

opening day by Dr. Alfred P. Haake, economist and lecturer of Largo, Fla.

There was a panel discussion on fair bidding procedures in which ethical standards are involved. The construction industry has developed a recommended procedure for handling sub-contract bids and action has been started in more than a score of cities and areas to adapt this plan in a campaign to stamp out the unethical and unfair trade practices of bid shopping and bid peddling. The panel included James M. Hunter, Boulder, Colo., vice president of the American Institute of Architects; L. B. Barrett, chief of the contract support division of the Army Corps of Engineers; W. E. Ray, assistant manager of the purchasing division of International Harvester Co.; and James D. Marshall, executive director of the Associated General Contractors.

Clint J. Harder, secretary-treasurer of NECA, reported that the membership this year had decreased over what it was at the end of 1959. On January 1, there was a total of 4,351 members; on August 31 there were 4,324, a loss of 27. 313 were dropped from membership, most at the beginning of the year for non-payment of dues. During 1960, 286 were added. Net income from dues and service charges as of August 31 was $1,095,320. Receipts during September brought the total to $1,113,887.

Industry Awards

Elwood Peele, Burlington, N. C., electrical contractor, received the Coggeshall Award for his contribution to the field of technical and training services. He developed a mechanical bookkeeping system which has improved business methods in the industry.

The first recipient of the Louis K. Comstock Award for outstanding contribution to the field of labor relations in the electrical industry was Ernest R. Edenfield of Nashville, Tenn. He has served continuously for eight years as a member of the Council on Industrial Relations of the Electrical Contracting Industry.

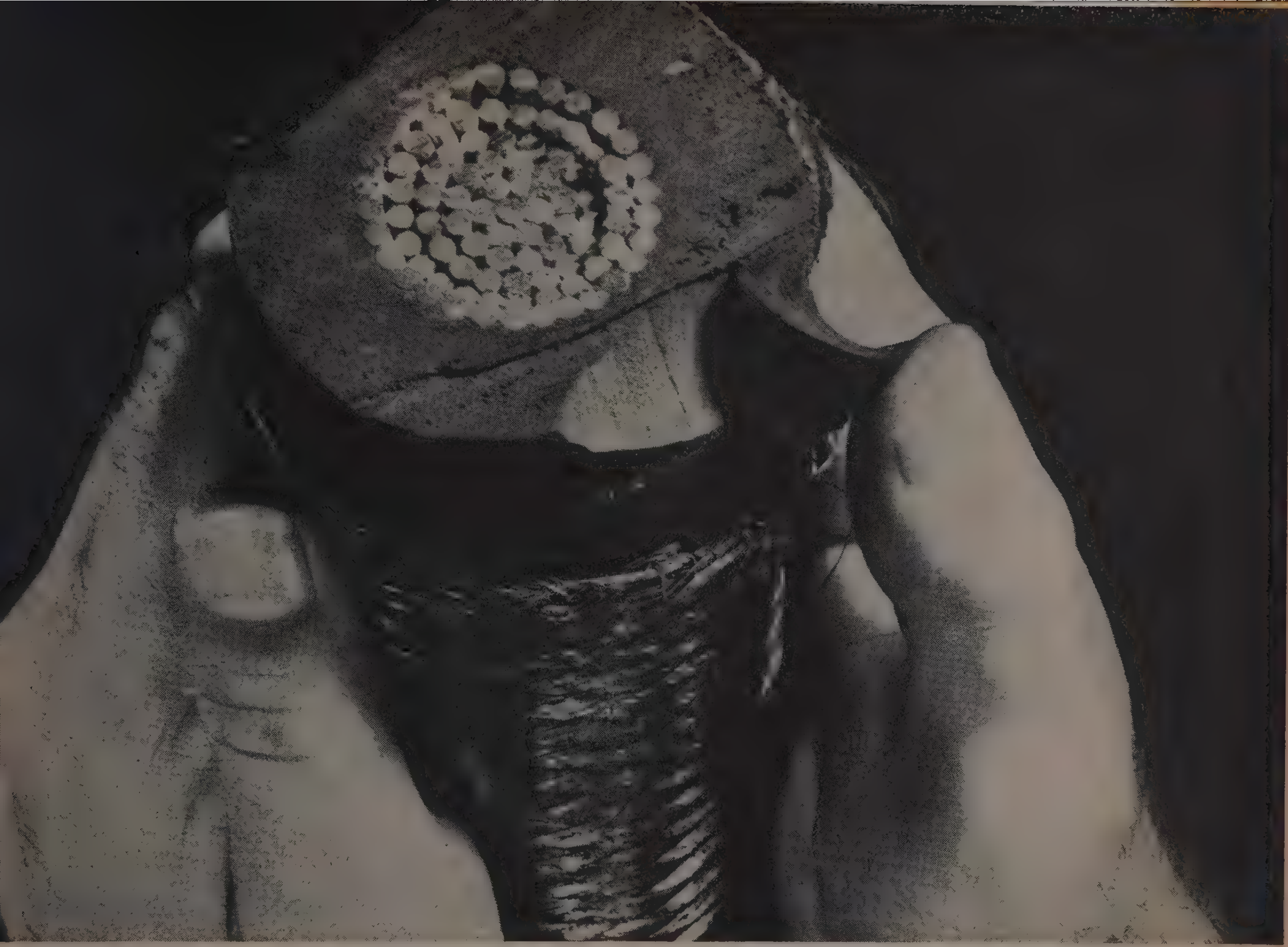
The James H. McGraw Award Contractors Medal was presented to Denis J. Crimmins, manager of the New York City Chapter of NECA, for his dedicated personal initiative and leadership in applying a new Charter to greatly broaden the membership base of the National Electrical Contractors Association in large cities.

Emphasis on Sales

The second General Membership Session, chairmanned by Norman D. Ferguson, president of California Electric Works, San Diego, and NECA vice president from District 9, was a stimulating analysis of sales. This presentation was launched by F. E. Keith, Chairman of NECA's Marketing Committee, who discussed association plans concerning sales training, urging contractors to promote higher quality installations by constructively educating their clients. Contractors have a valuable service to offer, he maintained, and should capitalize on all industry-backed promotion campaigns designed to extend this service, improve job quality and increase business opportunities in so doing.

Keith was followed by E. J. Thimme, general superintendent of distribution for New Jersey Public Service Electric and Gas Co., who cited numerous economic advantages related to employing independent contractors to perform utility pole-line and underground work. He stated that his company had formerly performed all of this work with their own crews, but it had been necessary to conduct schools for linemen who, as line work had increased, were being rushed through such schooling to meet the demand. The result was not completely satisfactory and, when centrally located utility crews were forced to work a 6-day week, it had been noted that travel time and overtime became exorbitant, crew morale dropped noticeably and work output lagged behind increased expenses. For these reasons some work had been contracted to independent line constructors on a trial basis and the experiment had proved so successful that over 500 "outside" linemen are now so employed to augment the work of company specialists and emergency crews. While utility unions initially protested this arrangement, the necessity was appreciated and is now accepted.

Long range forecasts conservatively predict that present line loads will double in a decade, Thimme continued, and it is expected that use of independent contractors will increase proportionately; this arrangement resulting in greater flexibility and mobility of smaller, locally based crews. Private enterprise would also be encouraged; tools and equipment would be purchased and maintained by qualified electrical contractors; utility personnel would be relieved of slack-time lay-off bugaboos and benefits would accrue to utilities,



AFTER 30 YEARS ON THE JOB . . . Okolite insulation still looks good. This unretouched photograph shows a section of 11.5 Kv power cable recently re-assigned by Duquesne Light Company. Note that the insulation is still flexible and resilient—workable. Tests made this year show the tensile strength has deteriorated very little, remaining more than 33% above the original specification figure.

30-year-old Okonite cable still tests above specification figures . . .

This is CABLE'BILITY *a new word for your vocabulary*

Cable'bility (cā'ble·bil'·i·ty) *new word.* *Noun.* **1.** Ability to design and manufacture electrical cables that give outstanding performance. **2.** Having long background and wide experience in cable research and application. **3.** Possessing keen understanding of customers' problems. Implies eagerness to serve faithfully and dedication to progress. **Syn.** The Okonite Company.

This is Okonite Cable'bility at work. It's "Old Faithful"—a 1250 MCM, Okolite-insulated power cable made in 1929, now carrying on a new career as a mine power feeder for Duquesne Light of Pittsburgh.

"Old Faithful" began service as an 11.5 Kv lead from switchyard to transformer, handling 15,000 KVA loads. During World War II, it saw fifteen years of full load operation, 24 hours a day. Then in 1957 it was replaced with a larger cable to handle even greater loads. But it was found still suitable for demanding tasks as a power feeder.

There are Okonite "Old Faithfuls" in use today in every application . . . *yours* too. Because, as in 1929, Okonite still produces the most dependable cables on the market. The reason is Cable'bility. The Okonite Company, Subsidiary of Kennecott Copper Corporation, Passaic, N. J.

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6990-A

the public and the contracting industry as well.

This general subject of sales was further explored by B. H. Benning and G. H. Booth of Graybar, also by IES past-president George Taylor of Day-Brite, all of whom discussed profit possibilities related to Relighting; by E. K. Handlan of Emerson Electric Manufacturing, who considered Electric Heating; by H. L. Cramer of Westinghouse, who analyzed profits related to Modernization, and by R. L. Kempton of the Edwards Co., who concentrated his remarks upon the category of Electronics.

In this practical roundup, Benning and Booth jointly presented a slide-film analysis of the relighting market, indicating that reliable products made by reputable manufacturers offer contractors the opportunity to provide customers with lighting mediums which are as practically efficient as they are aesthetically attractive. Citing the Blackwell report and the rapid acceptance of higher levels of illumination for *new* construction during the past two decades, they urged conferees to apply these same lighting standards when modernizing *existing* buildings as well. Such relighting installations should consider all-purpose quality fixtures, modern designs and construction details designed to speed installation time. They also stressed the importance of sales training for employees, using simplified selling methods, effective promotion and, where necessary, arranging for financing.

George Taylor likewise cited representative Blackwell recommendations for higher levels of illumination, stating that acceptance values had steadily increased during the lifespan of the Illuminating Engineering Society, rising from 5 footcandles in 1917 to 10 fc in 1930, 25 in 1942, 30 in 1947, 50 in 1952 and 100 today. He referred to case studies proving the values of higher footcandle levels, and indicated that higher lighting levels and increased volume of business in the lighting field went hand-in-hand.

Heating Potential Analysed

On the subject of electric heating, Handlan cited numerous user benefits and savings, new competitive power rates (now existing in 27 states), mounting sales, direct industry support and growing markets. In exploring this field he stated that over $16-million worth of electric heating equipment had been installed in 16,000 new homes last year, although this volume could be multiplied 10-fold if owners of existing homes could be persuaded to adopt this same heating medium. He also cited opportunities related to commercial and industrial markets, motels, factories, offices and the like. And, in reviewing such markets, Handlan mentioned that equipment selection depended largely upon the activity level of people occupying the structure to be heated, the desired temperature to be maintained and the appearance of the equipment.

Milton I. Minto, MacNutt Electric Co., New York City.

In discussing Modernization, H. L. Cramer of Westinghouse maintained that the country's existing buildings would experience a $200-billion face-lifting treatment during the coming decade because, as population grows and our economy expands, more buildings will be built to accommodate the growth, and owners of older structures will be *compelled* to modernize in order to hold tenants and protect their initial investments. He stated further that existing structures in America are presently valued at about $500-billion, and that economists predict that this figure will be more than doubled by 1970. Planned modernization of older structures is essential for long-range profits, he concluded, so it is essential that contractors, utilities, manufacturers, distributors and property owners team-up to Build Business Electrically.

Considering the Electronics market, Kempton of Edwards maintained that electrical contractors need not feel over-awed by high-sounding electronic terms, for a sizable portion of the electronics market is actually electrical rather than electronic in nature involving such components as relays, micro switches, variable-voltage transformers, PF capacitors and so on. Moreover, there is no reason why contractors should hesitate to service welding controls, security systems, photoelectric counting systems, clock and paging systems. And, in the field of heating and cooling, contractors should consider the installation of room thermostats, damper motors and control panels as well as the usual wiring of fans, pumps and compressors. He also referred to possibilities related to commercial sound systems. And, in summation, Kempton stated that basic principles of selling included application of imagination, anticipation of prospects' needs, effective demonstration of products, sales training and convincing clients that services offered by contractors are essential for their own best interests.

Line Constructors Convene

Utility Line Constructors' conference featured a field-problem panel discussion moderated by NECA vice president Gordon S. Heylin, Utilities Line Construction Co., Jenkintown, Pa. Panelists including Gordon M. Freeman, International President of the IBEW; Paul M. Geary, Executive Vice President of NECA, and James E. Swan, NECA's Director of Labor Relations.

This forum considered such timely questions as non-continuity clauses in utility contracts; limiting the amount of work that can be apportioned to outside companies, transfer of manpower, shifting crews and apprentices from one labor district to another for training purposes or in cases of disaster and emergencies the problem of union vs non-union labor employed by "different" companies having the same management; the subject of "pirate" companies of utilities "competing" with independent organizations for contracts with parent utilities; jurisdictional problems between various IBEW interest groups; also procedures prescribed for settling disputes via the industry's Dispute Board; the question of when should overtime be limited in extent; training programs and safety measures to be adopted in the field.

While appealing to a smaller number of contractors than other programs of the convention, this session was one of the most stimulating, practical, honest and informative meetings of the entire week.

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GENERAL ELECTRIC

Factors affecting the financial welfare of electrical contractors were highlighted under the chairmanship of John A. Beck, Baltimore, Md. He said the NECA workshop training program is beginning to pay off. This encompasses 2-day sessions of from 15 to 30 contractors held by various NECA Chapters and is designed to give members an opportunity to make comparative analyses of their business operations to seek out management strength and weakness. In the past nine months some 70 workshops with 1000 participants were held, reported W. Floyd Taylor, Schoonover Co., Inc., Mountainside, N. J., chairman of a contractor panel discussing program results. Among individual experiences related were the following:

Phil Stinchcomb, Philip Stinchcomb, Inc., Baltimore, Md., reported spending about $10,000 for advertising in newspapers, telephone classified directory and on direct mail. In one year, electric heating and housepower business paid for the advertising, but not for a special salesman, he revealed. He finds newspapers the best ad medium.

B. N. Voss, Circle-L Electric Co., Tulsa, Okla., is now using job factor adjustments in his estimating and requiring daily job progress reports. Workshop experience led him to revise his estimating and job cost procedures so he now knows where he is and where he is going in his business operation, he added.

Jack Mihalovich, Dahl-Beck Electric Co., San Francisco, Calif., believes lack of organization is a common denominator to many contractor problems. Workshop experience led his firm to develop a definite organization chart listing specific duties for all personnel. By eliminating overlaps and gaps and through better coordination of duties, overhead expense is being reduced, he reported.

Make a realistic budget of your business operations and try to adhere to it, recommended T. L. Watson, Jr., Watson Electrical Construction Co., Wilson, N. C. Such items as fixed overhead costs, tool replacements and equipment depreciation can give an insight into possible cost reduction and additions to productive capacity, he noted. His firm's experience with budgeting has been so good that it has become a "must," he intimated.

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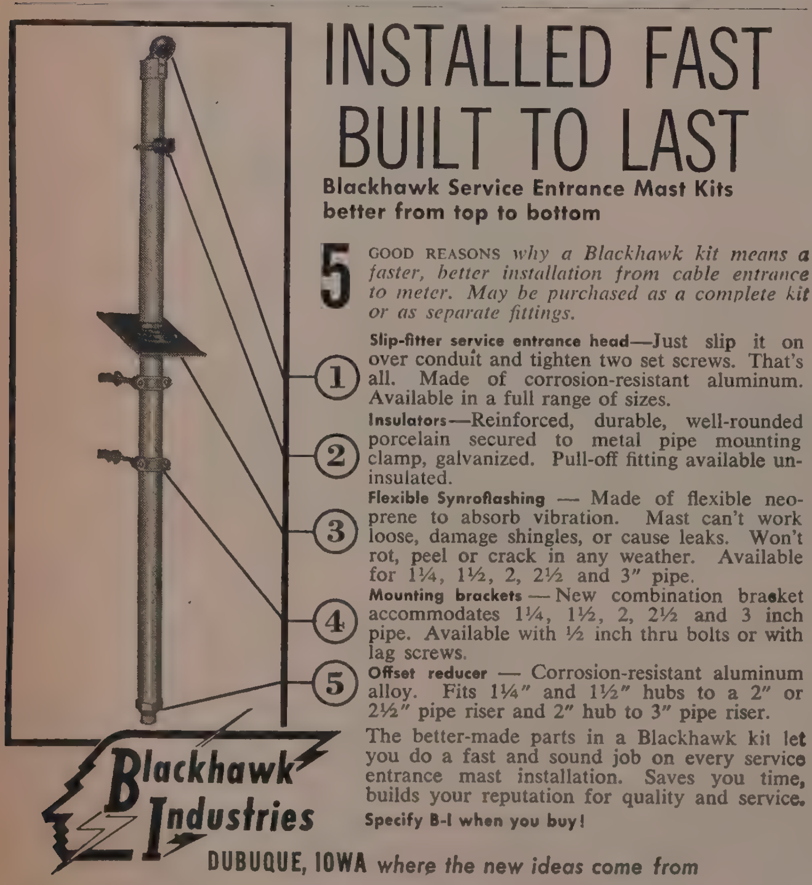
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Frank H. Oppitz, Oppitz Electric Co., and B. H. Barg, B. H. Barg Electric Co., both from Milwaukee, Wis.

of Labor Units? Opinion varied among a panel of three contractors. They were: E. R. DuBose, White Electrical Construction Co., Atlanta, Ga.; J. A. Beck, The Eastern Electric Co., Baltimore, Md.; and R. R. Ecker, Empire Electric Co., Pasco, Wash. Some contractors use the units. Others do not use them. Some question the origin and reliability of the units, feel they are too old, and point out the conspicuous lack of units on many new materials and methods. The research committee has experienced some difficulty in obtaining new units and rechecking existing ones since many contractors consider their operations too small to warrant personnel assignment to labor unit research. The panel revealed that NECA has assigned a full-time "time study engineer" who will travel the U. S. to field check labor cost data and evaluate existing units.

Possible development of a "NECA Code and Standard of Installation" based on contractor know-how was intimated by Richard W. Osborn, St. Louis, chairman of the NECA Codes and Standards Committee. He also predicted a more important contractor role in the National Electrical Safety Code—a compilation of National Bureau of Standards regulations covering line work.

While exceptions to the National Electrical Code are properly made by some cities and communities to exceed minimum safety standards, Osborn recommended that contractors oppose efforts to replace the NEC with separate local codes. The NEC provides a common denominator for the electrical construction industry and offers a set of nationally accepted uniform requirements on which wiring proposals can be based, he added. Mr. Osborn recommended establishment of

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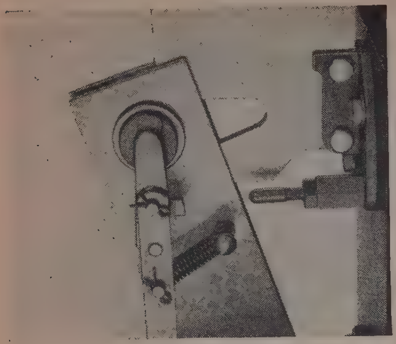
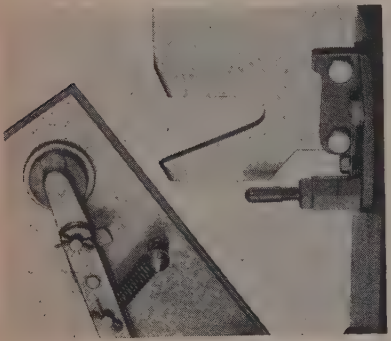


EVEN AFTER 10 YEARS



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code standard committees at the Chapter level, supplemented by code schools where possible; urged contractors to notify the NECA code committee of new techniques and desired code changes.

Get to know your banker before you need to borrow, urged Robert L. Gordon, vice president, Bank of America, Los Angeles, and a recognized expert on contractor financing. To get the most help from your banker, keep him fully informed of your business operations including individual job status and payment reports. To keep from courting disaster, set up a proper accounting system tailored to your specific operations and supplement it with professional auditing; determine cash requirements for bidding and contract fulfillment; discuss financial needs fully with your banker before bidding a job; be realistic in overhead allowances when making an estimate, he advised. Mr. Gordon warned against bidding low to get large volume or maintain crews. He noted that unsecured loans in construction circles often run up to 100% or 200% of true working capital compared to a normal banking rule of 40%.

Delegation of authority and communication with employees are major management problems, according to Dr. Robert A. Goodell, University of Southern California, Los Angeles. Proper resolution of both can lead to more profitable operation, he noted. Indulge in some self-analysis at management level. If you are doing more than 20% of work in a subordinate area, you are not delegating properly, Goodell stated. Control delegated work through conference-type oral sessions; avoid a tendency to overcriticize; be judicious in corrective action when needed; recognize personnel who do good work with a little praise, he advised.

Try to learn the "language of management" and be able to talk to subordinates in terms they can understand and appreciate, Goodell continued while noting that studies show that 65% of top management thinking is lost by the time it reaches the worker. Research on "listening comprehension" is now being conducted and the need for training courses on "how to listen" is indicated, he concluded.

Production

Production was the theme of the fourth general membership session. Emphasis was on the labor relations factor.

Jack Ketzscher, North Little Rock Electric Co., North Little Rock, Ark.; William Flowers, Flowers Electric Co., Abilene, Texas; Charles Nelson, Charles Nelson Electric, Lubbock, Texas.

The role of NECA's Labor Relations Department in settlement of problems on national, district and local levels was reviewed by director James E. Swan. The Council on Industrial Relations heard and decided 78 cases during the past year. NECA continues its co-sponsorship of the National Joint Apprenticeship and Training program. More than $1-million is being contributed by labor and management to finance some 274 programs under labor agreement terms. In 1960 there were 19,416 apprentices registered and 2,480 completion certificates were issued.

For the first 9 months of this year, National Electrical Benefit Fund collections totaled $7,372,421 or better than $800,000 per month. Of the 11,992 employers reporting the one percent assessment, 40% were NECA members. Studies are now under way by two independent actuarial consulting firms to develop a possible NECA-IBEW plan to progressively nationalize all fringe benefit items for production employees in the electrical contracting industry. Suggestions include: a pension which when added to Social Security would equal 50% of the average electrical workers earnings; hospitalization, surgical and major medical insurance; a fund for apprentice, advance journeyman and foreman training; a fund for industry business development including management, sales and administrative personnel training.

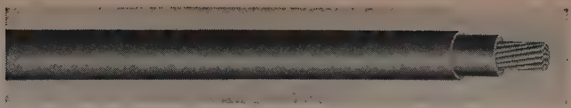
NECA continues its membership in the Construction Industry Joint Conference where representatives of the entire construction industry can meet to discuss mutual problems. Biggest problem during the past year has been missile base construction. Through joint efforts of the CIJC, the Department of Labor, the Air Force and the Department of Defense, the government is recognizing the need of approaching construction of missile bases on a more traditional basis of the construction industry.

The CIJC feels that if the missile program follows the basis of the Atomic Energy program, so far as the construction industry is concerned, many of the present problems will clear up. Present indications are that this approach will be followed. Further indication of such cooperation was given by C. J. Haggerty, president, building trades department, AFL-CIO, in his discussion of the missile base construction program.

The relationship between on-the-job safety and production exposes a wide area for labor-management promotion of electrical construction safety standards, stated Milton I. Minto, MacNutt Electric Co., New York City. Adequate job tooling and good on-the-job housekeeping helps prevent accidents, but a well-organized safety program really pays off. Minto explained the New York plan which covers some 460 employers and 10,000 electrical workers. A full-time safety group manager spends most of his time on accident prevention work. Typical program aids include: a safety film, job posters, payroll stuffer cartoons, bi-monthly newsletters. Any project with 15 or more men has a safety program tailored to its requirements; has a weekly 10-minute safety meeting. Net result: safety-conscious management and workers; reduction in workman's compensation rates; more production.

Cost of this program over the past 5 years averaged one-cent per man-day and returned an estimated 10 cents per man-day. The New York group now plans to study "near-miss" accidents to determine frequency and causes, Minto revealed. Programs like this and the IBEW employee safety program are part of an all-out attack on the construction industry accident rate which, at 30 per million man-hours, is the highest of any industry, he noted.

A "bottleneck" of giant proportions is facing electrical contractors and must be broken if they are to survive in these rapidly changing times, warned Gordon M. Freeman, international president, IBEW. This is the alarming trend toward absorption of electrical contracting industry functions by other branches of the electrical industry, construction industry, and industrial and utility "in-plant" employees. While electrical energy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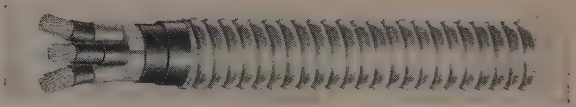
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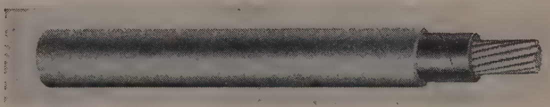
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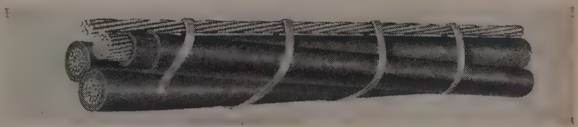
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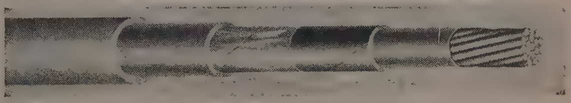
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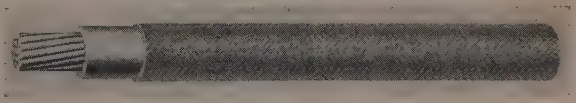
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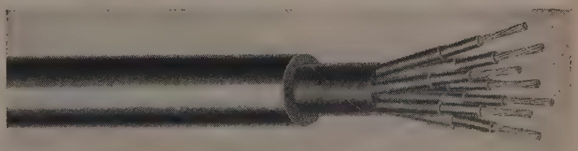
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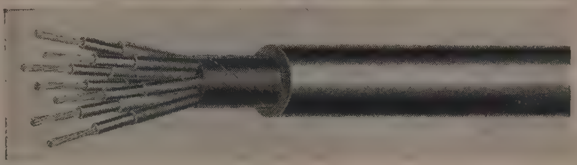
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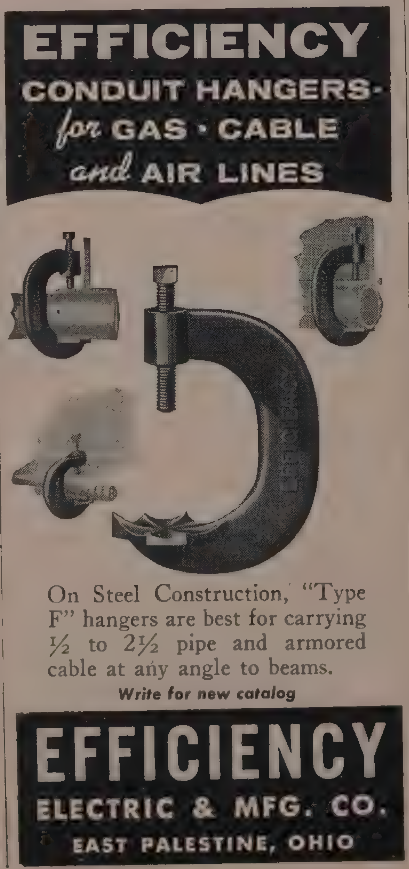
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consumption has doubled in the past ten years, the number of electrical workers employed by contractors has increased less than 20%.

The latest Social Security Board figures show a total of about 21,000 electrical contractors in the U.S. employing about 160,000 production workers. National Electrical Benefit Fund records indicate 12,000 contractors employ about 130,000 IBEW members. Current estimates of experts indicate the annual market for services of electrical contractors in the U.S. runs about $15-billion annually, which should provide employment for about 500,000 electrical workers, he noted.

Freeman placed the responsibility of getting "by others" electrical work in the laps of electrical contractors who must get out and do some creative selling instead of competitive maneuvering. It's time for electrical contractors to employ salesmen and convince general contractors, owners, architects and engineers that electrical contractors employing trained electrical workers are best qualified to perform all work regarded as electrical work.

Business Session

NECA vice presidents unanimously elected by the Board of Governors were: District 2—Robert G. Frame, Frame Electric Co., Pittsburgh, Pa.; District 4—E. E. Leasure, Jr., Monroe Electric Co., Chicago, Ill. (reelected); District 6—Howard E. Bayley, Industrial Electric Co., Seattle, Wash.; District 8—C. I. Berrell, Howard P. Foley Co., Inc., Salt Lake City, Utah.

Convention delegates unanimously approved these resolutions:

Missile Base Construction—That NECA use its influence with the Construction Industry Joint Conference and other organizations representing labor and management groups in the construction industry to stimulate a vigorous effort to assure that the construction industry perform its claimed functions in the missile development program with dispatch, quality and economy.

Andrae and Beister—That NECA record its appreciation of the many years of outstanding service rendered the industry by George Andrae, Milwaukee, Wis., and William H. Biester, Jr., Philadelphia, Pa., who for thirty and twenty years respectively have served as members and chairmen of the NECA Codes and Standards Committee; have represented NECA on the National Electrical Code Corthe National Electrical Code Correlating Committee and Code Making Panels, NFPA and ASA. Both men, at their own request, have retired from these activities.

Among resolutions approved by the NECA Board of Governors were the following:

Membership—That NECA promote an increase in Chapter membership throughout the country and publicize the New York City Plan and the Bylaws used to permit unaffiliated associations to become Chapter members without loss of their former identity and that studies be initiated which may lead to lower national membership cost as membership increases.

The Sixth National Electrical Exposition was held in conjunction with NECA convention at Exposition Hall of the Convention Center, October 24 through October 26. Displayed were product application displays of 197 manufacturers, suppliers and institutions.

McGraw Awards Presented

J. F. Lincoln, Chairman of the Board of the Lincoln Electric Co., Cleveland, Ohio; Everett Morss, President of Simplex Wire and Cable Co., Cambridge, Mass.; and N. J. MacDonald, President of the Thomas and Betts Co., Elizabeth, N. J., received awards under the James H. McGraw Award for Electrical Men at the general meeting of the National Electrical Manufacturers Association on November 17 at the Savoy Hilton Hotel in New York City.

Mr. Lincoln received a Manufacturers Medal and Purse for "his dedicated and creative leadership in developing the electric welding process and in fostering its extensive and beneficial application to the broad benefit of the electrical industry."

Mr. Morss received a Manufacturers Medal and Purse for "his initiative and dedicated industry leadership in the development of modern synthetic insulation for electrical conductors to the great benefit of the electrical industry."

Mr. MacDonald received a Medal for Cooperation and Purse for "his dynamic personal leadership dedicated to the coordination of the efforts of all branches of the electrical industry toward common objectives in the spirit of industry interdependence and service to the public."

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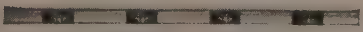
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mended Mr. Lincoln and Mr. Morss for the Manufacturers Medals were Robert Paxton, President, General Electric Co.; A. D. R. Fraser, President, Rome Cable Co.; F. F. Loock, President, Allen-Bradley Co.; and W. T. Stuart, Secretary of the Committee of Awards.

The panel of Judges who recommended Mr. MacDonald for the Medal for Cooperation were J. W. Frommer, President, L. K. Comstock Co., Inc.; W. E. Henges, President, Graybar Electric Co.; Carl S. Menger, President, Triangle Conduit and Cable Co., Inc.; C. Wesley Meytrott, Vice President, Consolidated Edison Co. of N. Y.; and W. T. Stuart, Secretary of the Committee of Awards.

FAEC Holds 1960 Annual Convention

Highlighted by a well-rounded business program of vital interest to all electrical contractors, from the smallest to the largest, the Florida Association of Electrical Contractors (FAEC) held its 1960 Annual Convention and 8th Electrical Trade Show in Miami Beach in mid-October. Over two hundred members registered for the three-day session, as well as many representatives from the allied fields.

The allied 8th Annual Electrical Trade Show comprised displays of the newest in electrical materials, devices and equipment in 77 booths, by over sixty manufacturers, distributors and electric utilities.

President Richard Williers outlined the challenge facing the electrical contractors of Florida—a 61% increase in state population by 1970, an increase of 700 new customers daily, an expanding market potential second to none in the nation, exciting new products, fast-growing technical progress, and many others. FAEC is a hard-hitting progressive organization, he said, dedicated to new heights of achievement, to continued growth in the electrical industry, and to greater service to its membership.

William B. Shenk, vice president of the Florida Power Corporation, discussed "The Utilities Role in Reaching for the Sun in '61," also "Unify to Electrify," which was illustrated with a set of appropriate color slides, and devoted in great part to the furtherance of the Medallion Home program. He reported that 3985 Medallion Homes were certified in Florida during the first seven months of 1960, and that the FAEC goal of 5000 Medallion Homes for the year will be more than reached.

Under the chairmanship of Howard L. Palmer, past-president of FAEC, the story of FAEC—past, present, and future—was reviewed. The creed of the association is "Cooperation is essential to the success of our profession," he stated, and then proceeded to review the Association's objectives. James Dandelake, past-president, reviewed the FAEC history. Axel Ornberg, another past-president, discussed "Where FAEC is Today," and James R. Ward, 1st Vice President (1959–60) outlined "Where FAEC is Headed."

An Estimating and Pricing Workshop was held, which was handled by William A. Ritt, Director-at-Large, and Harry W. Kane, Manager, Minnesota Electrical Association, authors and originators of the "Estimating-Accounting Manual for Electrical Contractors and Dealers," which has been FAEC-sponsored for its membership. The Manual and a variety of business forms and new profit control methods were reviewed, explained, and discussed at length by both Mr. Ritt and Mr. Kane.

A factual report covering the operation of three separate electrical contractors in Florida—one large, one medium, and one small—was presented by Harry Hurst, legal counsel of Tampa, Fla., to help answer the question "Is Volume Hurting Your Profits?"

The session on electric space heating was chairmanned and introduced by W. J. Novak, Associate Editor, *Electrical Construction and Maintenance.*

George Klein, manager of Lowry of Florida, discussed the subject "Is the Heat Pump In Your Future?" He first reviewed how his firm got into the business, types of equipment, etc., then advised the electrical contractors to first check with their local electric utilities, air conditioning manufacturers and others, discuss market possibilities, learn all the facts—*then* decide *what* units to use, get a dealership, and go ahead.

J. L. Shoemaker, Director of Market Research, Florida Power Corporation, discussed "The All-Electric Story Comes of Age—Economically," in which he compared the relationship of a man's ability to pay with home costs over the past several years, and concluded that the changing nature of the American labor force has made the all-electric home practical. He predicted that 6 million homes will be electrically heated by 1970, and pointed out that insulation is a key to a successful heating installation, and urged electrical contractors to become familiar with the facts of insulation properties, methods and techniques.

Gilbert Leach, electric heating specialist with Tampa Electric Co., described and explained a "Simple Slide Rule on Electric Heat" which has been developed for use in the Florida area.

"Electric Heating in the Modernization Market" was discussed by W. J. Novak, who then summarized the panel discussions and outlined in considerable detail some of the problems ahead which may be expected. He also pointed out that much research is currently under way, covering such fields as dry air, comfort, insulation, etc.

Newly elected FAEC officers for 1961 are as follows: James R. Ward, Bradenton, President; John LaTour, Jr., Daytona Beach, 2nd Vice President; Thomas Drage, Jacksonville, Treasurer; and Curtis Lee Futch, Titusville, Recording Secretary.

Time to Probe Leagues Told

A very dissatisfied group of officers of the International Association of Electrical Leagues told members at their 25th Annual Conference in Kansas City's Hotel President that it is time for some good old-fashioned self-evaluation and probing. As the three-day meeting progressed, many became aware of the shortcomings in their own operations and saw opportunities for improvement.

IAEL President C. C. Simpson (Chicago, Ill.) set the stage in his keynote speech. A recent survey of all league operations revealed a dire need for comprehensive re-evaluation of local programs, he noted. The rate of league growth has been entirely too small. While there are 60 leagues today, there should be 100. Many major cities have none. Simpson sees the need for more aggressive association leadership to expand the league movement and help existing leagues to operate more aggressively in their respective market areas. At a later business session, he asked for creation of a committee to draw up a master plan for new league development and aid to existing faltering ones.

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Using the Electric Association of Chicago as an example, H. C. Moses, past-president of that group and vice president, The Thomas & Betts Company, outlined a step-by-step re-evaluation procedure used in Chicago. Net result: changes in working committees and divisions to encompass wiring in new and old homes, industrial and commercial structures, sound and communication field; establishment of an Educational Committee. To keep pace with progress, you have to re-evaluate your own operations, revitalize your promotions and co-ordinate all segments of the electrical industry, he concluded.

Among electrical industry activities discussed at the conference and open to league participation were the following:

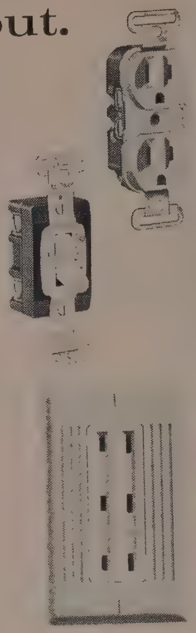
Industrial Electrification Council—The objectives of this EEI Council are almost interchangeable with those of leagues, according to F. F. Dickman, West Penn Power Co., Greensburg, Pa. Local leagues can promote and conduct Council developed courses on industrial electric heating, industrial power distribution, process heating and others to be organized.

Electronics—Leagues should include training courses on electronic and automatic devices to upgrade service in area, suggested W. D. Renner, vice president, industrial division, Howard W. Sams & Co., Inc., Indianapolis, Ind. Electrical distributors better take a long look at the growing electronics industry and be able to service industrials with electronic parts. If not, electronic distributors will get the business.

Electrical Modernization — A tremendous market in electrical modernization alone offers unusual opportunities. But it is going to take hard-selling customer-contact programs which can be sparked by leagues to get this business, according to J. D. Witherspoon, Westinghouse Electric Corp., Pittsburgh.

Electric Space Heating—The electric utility industry has underestimated the growth potential of electric space heating, believes K. M. LaRue, general sales manager, Kansas Gas & Electric Co., Wichita, Kansas. Establish a definite policy and competitive rates; train employees through a "heating specialist"; inform customers of the advantages of electric heat; establish an "electric heat task force" encompassing electrical contractors and insulation installers.

LBE Program—This program to unite the entire electrical industry



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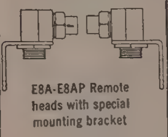

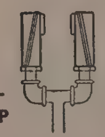

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behind competitive selling of the "total electrical living" concept is rolling. Latest campaign, reviewed by J. H. K. Shannon, LBE Planning Committee chairman, covers electric space heating and the Gold Medallion Home.

Medallion Homes — Results of the Medallion Home program are excellent. But the future can be much better, according to George T. Bogard, manager, residential market development operation, General Electric Co., Louisville, Ky. Gold Medallion Homes are 30% ahead of last year with the ratio now being one Gold to two Bronze Medallion homes. Bogard pointed out that electrical contractors can increase the value of their contracts from 50% to 100% when doing Medallion homes; noted that the IBEW in one area is financially supporting Electric League promotions because Medallion homes increase labor on the job.

The following officers were elected at the business session:

President—W. M. Freudigman, Providence, R. I.; vice president—R. J. Harrison, Omaha, Neb.; secretary—S. E. Strunk, Cleveland, Ohio; treasurer—Robert Trottier, Salt Lake City, Utah.

Elected to represent their respective geographical districts on the IAEL Board of Governors were the following league managers: Div. I, J. A. Morrison, Philadelphia, Pa.; Div. II—H. E. Cook, Detroit, Mich.; Div. III—Harry Guest, St. Louis, Mo.; Div. IV—C. L. Weaver, Medford, Ore.; Div. V—H. J. Foy, Toronto, Ont., Canada. Immediate past-president C. C. Simpson, Chicago, is an advisory member of the Board.

NISA News

Approval of a special promotion to publicize the change in name of the National Industrial Service Association, Inc., to Electrical Apparatus Service Association, Inc., next April 1 was approved by the NISA-EASA board of directors at its mid-year meeting November 11-12 in St. Louis.

Promotional literature and publicity aids will be placed in the hands of the membership in an effort to gain local publicity throughout the United States and Canada, according to C. S. Moran, chairman, NISA-EASA Publicity Committee. The promotion will be handled through the association's public relation counseling firm, Mr. Moran said.

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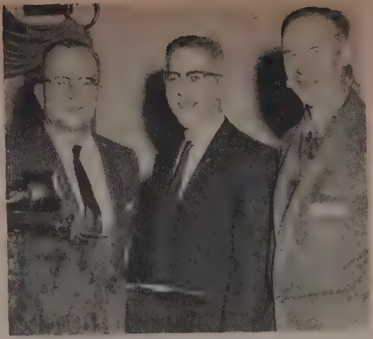

AT A RECENT MEETING in St. Louis of officers of the Electrical Apparatus Service Association (new name for NISA): J. Arthur Turner Jr., national NISA-EASA president of Tampa Armature Works, Tampa, Fla.; Eldon T. Strom, Strom Electric Co., Troy, Idaho; and Gordon O. Toms, Toms Electric Co., Spokane, Wash.

In other actions, the NISA-EASA board:

- Approved the associate memberships of New Jersey Wood Finishing Co., Mamco Corp., Advance Carbon Co., and Schenectady Varnish Co., Inc.
- Elected George Larsen, of Larsen-Hogue Electric Co., Los Angeles, Calif., as its next president, to take office at the 1961 EASA Convention in San Francisco, Calif., June 11-14.
- Elected Ben Horton, of The Atkinson Armature Works, Pittsburg, Kansas, as vice-president; and Thomas Paul, Paul Electric Co., Sioux City, Iowa, as treasurer, both to take office with Mr. Larsen next June.
- Re-elected Alex J. Shovan, of Industrial Electric Service Co., Hawthorne, N. J., as treasurer.
- Selected Chicago as its 1962 convention site and Texas for 1963, specific locations and dates to be announced.
- Approved a 2nd NISA-EASA Management Seminar for early 1962 in Chicago, conducted by the St. Louis University faculty.
- Approved a series of Electronics seminars to be held in early 1962 in several locations across the country to be announced.

Attending the directors meeting at Clayton Inn were: A. G. Bamford, Kitchener, Ont.; H. C. Blenkhorn, St. Catherines, Ont., W. G. Brush, Birmingham, Ala.; J. F. Ferrari, Sr., Chicago; J. G. Hammond, Rocky Mount, N. C.; S. F. High, Cincinnati; B. J. Horton, Pittsburg, Kansas; G. E. Jones, Amarillo, Texas; E. E. Kolhonen, Peabody, Mass.; R. O. Kufen, Philadelphia; George Larsen, Los Angeles; Carl Lundberg, Seattle, Wash.; W. C. Mielke, Duluth, Minn.; C. S. Moran, Detroit; T. M. Paul, Sioux City, Iowa; Alex Shovan, Hawthorne, N. J.; Earl Brooks, Seattle, Wash.; Edward Potter, Lima, Ohio; and Paul Bush, Lubbock, Texas. J. Arthur Turner, Jr., national president, presided. Also present were members of the St. Louis headquarters staff, J. M. Harrington, Kenneth Mitchell and Gus Baechle.

• • • •

Twenty-five shop men attended the welding seminar held October 29 in Columbus, Ohio and sponsored by the Central Ohio Chapter of NISA-EASA in cooperation with Eutectic Welding Alloys Co.

The program began with a film, then demonstrations of gas and electric welding processes and soldering.

• • • •

During November the following chapters met:

- Connecticut Chapter, at Waverly Inn, Cheshire, Conn., to hear Harold E. Hill of the Hartford Unemployment Compensation Department, Nov. 3.
- Los Angeles Chapter, at Michael's Restaurant, Los Angeles, after a tour of Tri-State Supply Corp., November 15.
- New England Chapter, at Hotel Bradford, November 10, to hear a program on quality control by a representative of Electro-Dynamic.
- Northern California Chapter, at Veneto's, San Francisco, November 7, to plan the 1961 EASA Convention.
- Quaker City Chapter, at Beck's Restaurant, November 9, to hear Ron Clark of Phelps Dodge Corp. discuss magnet wire.
- Southeastern Chapter, at Jack Tar Poinsett Hotel, Greenville, S. C., November 3-5, to hear Lee A. Teichthesen, of Dow Corning Corp.; James Fenske, of Allis-Chalmers; Gus Baechle, of NISA headquarters; and J. Arthur Turner Jr., NISA-EASA president.

• • • •

The big Southwestern Chapter (Texas size) has re-elected its vice-presidents, James A. Phares of Oklahoma City, and J. M. Morgan of Fort Worth, Texas, and its secretary-treasurer, Connie H. Henry of Dallas. President George Kinard's term expires in 1962.

New directors for the organization are Lester Luton, Ada, Okla.; Homer D. Russell, Kilgore, Texas; George Shields, Corpus Christi, Texas; Frank J. Arriens, Bryan, Texas; Clyde N. Brown, North Little Rock, Ark.; and Paul Beresic, Phoenix, Ariz.

DATES AHEAD

Industrial Heating Equipment Association, Inc.—Dearborn Inn, Dearborn, Mich., January 23-24, 1961.

Plant Maintenance and Engineering Show—International Amphitheatre, Chicago, Ill., January 23-26.

American Institute of Electrical Engineers—Winter General Meeting, Hotel Statler, New York, N. Y., January 29-February 3.

Intermountain Electrical Association—Annual conference, Hotel Ben Lomond, Ogden, Utah, February 2.

Power & Communications Contractors Association—Annual convention, Sir Francis Drake Hotel, San Francisco, Calif., February 5-7.

National Electrical Week — National promotion, February 5-12.

National Rural Electric Cooperative Association—19th annual meeting, Dallas, Texas, February 13-16.

15th International Heating & Air-Conditioning Exposition—International Amphitheatre, Chicago, Ill., February 13-16.

3rd Biennial Electrical Trade Conference and Exposition—Sheraton-Park Hotel, Washington, D. C., February 14-16.

Upper Midwest Electrical Industry Convention — Leamington Hotel, Minneapolis, Minn., February 19-22.

National Electric Sign Association—Convention, Benjamin Franklin Hotel, Philadelphia, Pa., Feb. 19-22.

Electrical Show—1961 Denver Electrical and Electronics Exhibit, Denver Hilton Hotel, Denver, Colo., February 21-22.

17th Annual National Wiring Sales Conference—Sherman Hotel, Chicago, Ill., February 23-24.

3rd National Lighting Exposition and World Light Forum—Coliseum, New York City, N. Y., March 8-15.

Edison Electric Institute — Annual sales conference, Edgewater Beach Hotel, Chicago, Ill., March 20-22.

American Power Conference — Sherman Hotel, Chicago, Ill., March 21-23.

Nebraska Iowa Electrical Council—4th Biennial Nebraska-Iowa Electrical Trade Show, Peony Park Auditorium, Omaha, Neb., March 21-23.

International Association of Electrical Inspectors—Chapter Meetings—**Mississippi**, Heidelberg Hotel, Jackson, Miss., March 27-28; **Georgia**, Forrest Hotel, Rome, Ga., April 10-11; **Ellis Cannady**, Carolina Hotel, Raleigh, N. C., April 12-13; **Alabama**, Tutwiler Hotel, Birmingham, Ala., April 17-18; **South Carolina**, Cabana Inn, Spartanburg, S. C., April 20-21; **Five Chapter Joint Meeting**, Windsor Hotel, Abilene, Texas., April 28-29; **Florida**, Casa Marina Hotel, Key West, Fla., May 5-6; **Virginia**, Hotel Roanoke, Roanoke, Va., June 12-13; **Northwest Section**, Owyhee Hotel, Boise, Idaho, September 11-13; **Southwest Section**, Southern California, September 18-20; **Western Section**, Oklahoma City, Okla., September 25-27; **Canadian Section**,

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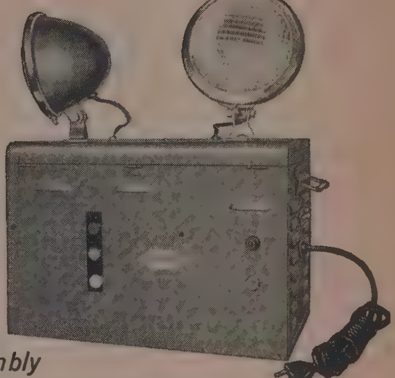

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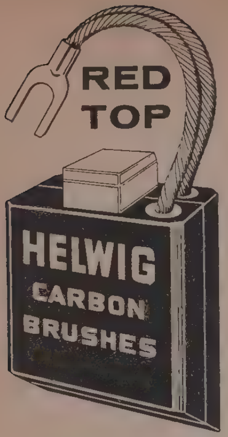

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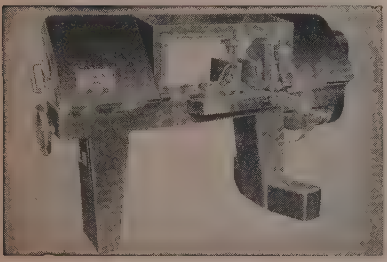

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Montreal, Quebec, September 29-30; Eastern Section, October 9-11; Southern Section, Grove Park Inn, Asheville, N. C., October 16-18.

Electrical Supply Trade Show—Sponsored by the Electrical Association of Kansas City, Exhibition Hall, Municipal Auditorium, Kansas City, Mo., March 28-30.

Electrical Trade Show—Sponsored by St. Louis Electrical Board of Trade, April 4-6.

Northern California Electrical Industry Show—Sponsored by the Electrical Maintenance Engineers' Association of Northern California, Brooks Hall, San Francisco, Calif., April 5-9.

1961 Electrical Home Show—Community War Memorial, Rochester, N. Y., April 8-15.

Missouri Valley Electrical Association—Annual engineering conference, Hotel President and Municipal Auditorium, Kansas City, Mo., April 12-14.

2nd Annual Alabama Electrical & Electronics Exposition—Birmingham Municipal Auditorium, Birmingham, Ala., April 17-19.

National Association of Electrical Distributors—53rd annual convention, Detroit, Mich., April 29-May 3.

National Fire Protection Association—Annual convention, Hotel Statler, Detroit, Mich., May 15-19.

Edison Electric Institute—Annual convention, New York, N. Y., June 5-7.

Electrical Apparatus Service Association, Inc.—28th annual convention, Jack Tar Hotel, San Francisco, Calif., June 11-14.

New York State Association of Electrical Contractors & Dealers—62nd annual convention, Whiteface Inn, Lake Placid, N. Y., July 2-7.

Western Plant Maintenance Show—Pan American Auditorium, Los Angeles, Calif., July 18-20.

National Assn. of Lighting Maintenance Contractors—National conference, Las Vegas, Nev., August 21-23.

Western Electronic Show and Convention—Cow Palace, San Francisco, Calif., August 22-25.

American Home Lighting Fixture Month—Sponsored by the American Home Lighting Institute, Chicago, Ill., September 1-30.

Illuminating Engineering Society—National Technical Conference, Chase Park Plaza Hotel, St. Louis, Mo., September 24-29.

International Association of Electrical Leagues—25th Annual Conference, President Hotel, Atlantic City, N. J., October 4-6.

Canadian Electrical Manufacturing Association—Annual meeting, Sheraton Brock Hotel, Niagara Falls, Ontario, October 4-6.

17th Annual National Electronics Conference—International Amphitheatre, Chicago, Ill., October 9-11.

National Electrical Contractors Association—Annual convention, Washington, D. C., October 9-14.

National Electrical Manufacturers Assn.—Annual meeting, Traymore Hotel, Atlantic City, N. J., Nov. 13-17.

Among the Manufacturers

Headquarters Announcements

Studebaker-Packard Corp., South Bend, Ind., has acquired **D. W. Onan & Sons, Inc.,** Minneapolis, Minn., which will become the Onan Division. C. Warren Onan will remain as president and new appointments are: Roy E. Mullin, vice president in charge of marketing; William J. Auger, assistant general sales manager; George R. Burda, manager, sales administration; David Onan II, manager, market planning and promotion.

Westinghouse Electric Corp., Pittsburgh, Pa.—William H. Loeber, manager, Residential Marketing Dept.

S & C Electric Co., Chicago, Ill.—Jack B. Castle, manager, new Sales Service Div.

Diehl Mfg. Co., Somerville, N. J.—W. O. Langille, chairman of the board; Leonard C. Marsac, president and member of the board of directors.

Gould-National Batteries, Inc., Trenton. N. J. — John Robert Tench, vice president of industrial sales.

Barth Engineering & Mfg. Co., Meriden, Conn.—Don P. Caverly, president, general manager and director.

Allis-Chalmers Mfg. Co., Milwaukee, Wis.—J. H. Burrus, manager; John M. Crawford, assistant manager; Robert N. Miers, consultant; Oscar A. Haas, manager of specialty products—all with the new Thermal Power Department, Power Equipment Div.; C. L. Brisley, chief industrial engineer and L. M. Dings, Jr., chief production engineer, West Allis Works.

Lighting Dynamics, Div. of John C. Virden Co., El Monte, Calif.—Paul LaVigne, general manager.

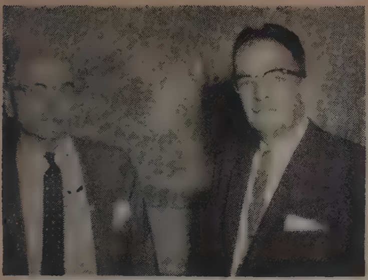
Black & Decker Mfg. Co., Towson, Md.—Charles L. Costa, field manager, Product Service Div.

Miller-Stephenson Chemical Co., Inc., South Norwalk, Conn.—Arthur Seger, Jr., vice president and treasurer.

Line Material Industries, McGraw-Edison Co., Milwaukee, Wis.—Fred Burtner, director of management development.

Emerson Electric Mfg. Co., St. Louis, Mo.—William L. Davis, executive vice present.

Pacific Semiconductors, Inc.,



EXCHANGING THOUGHTS on code matters at the 36th annual meeting of the recent Eastern Section IAEI meeting in Portsmouth, N. H., are: Sterrett L. Clark (left), chief electrical inspector for the City of Pittsburgh; and Russell P. Northup (right), Crouse-Hinds Co., Syracuse, N. Y.

Lawndale, Calif.—John F. Hinchey, director of quality control.

J. I. Case Co., Racine, Wis.—Henry J. Maubert, vice president.

Atlee Corp., Waltham, Mass.—Bernard J. Warren, manager of development engineering.

Thomas Industries Inc., Louisville, Ky.—Robert Gand, director of merchandising, Benjamin Div.

H. K. Porter Co., Inc., Pittsburgh, Pa.—Lyle V. Martin, advertising manager, Thermoid Div.

General Electric Co., Schenectady, N. Y.—Robert A. Cliff, manager of industrial sales administration operation, Industrial Sales Operation; Robert J. Rodwell, manager of marketing, General Purpose Control Dept., Bloomington, Ill.

Electric Products Co., Cleveland, Ohio—Edward G. Schroeder, vice president and director in charge of engineering and sales.

Columbia Cable & Electric Corp., Brooklyn, N. Y.—Michael T. Regan, general sales manager; Michael J. St. John, general manufacturing manager.

Regional Appointments

NEW ENGLAND

General Electric Co.: Robert L. Daileader, sales representative, located at Bridgeport, Conn., Silicone Products Dept.

H. K. Porter Co., Inc.: J. B. Nicholson, Boston branch manager, National Electric Div.

The Gamewell Co.: John B. Russell, sales engineer in Connecticut.

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General Electric Co.: James S. J. Berray, sales representative, Eastern District, Silicone Products Dept., located at Drexel Hill, Pa.; Parker C. Finn, sales repre-

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Progress Mfg. Co.: Frank Cody, regional manager, Southeastern Sales region, located at Atlanta, Ga.

EAST CENTRAL

Kaiser Aluminum & Chemical Corp.: Edward K. Matteson, North Central regional sales manager at Chicago, Electrical Conductor Div.

Federal Pacific Electric Co.: John N. Hutson, North Central regional manager for greater Chicago area, Indiana, Illinois, Wisconsin, Minnesota, and North and South Dakota.

The Paine Co.: Charles F. Fleming, sales representative, operating out of Cleveland, Ohio.

Black & Decker Mfg. Co.: James C. Vassell, branch service manager, Lincolnwood (Chicago), Illinois branch; S. Michael Raymond, manager of the Des Moines service branch.

General Electric Co.: Lawrence D. Stoddard, sales representative, East Central district, located at Cleveland, Ohio, Silicone Products Dept.

Nelson Electric Mfg. Co.: James E. Van Effen, sales manager, located at Chicago.

Wolverine Tube: M. D. Julian, sales representative in the Milwaukee area.

International Register Co.: Mack J. Haraburd, Chicago regional sales manager, Distributor Products Div.

WEST CENTRAL

Kaiser Aluminum & Chemical Sales, Inc.: George E. Hubrig, Kansas City, Mo., regional manager, Electrical Conductor Div.

Allis-Chalmers Mfg. Co.: J. S. Quinn, manager, Omaha, Nebraska district office.

Walker Brothers: George P. Mitchell, Crestwood, Mo., sales representative covering southern Illinois and Missouri.

Paragon Electric Co.: Dwaine O. Johnson, district marketing-manager for the Minneapolis-St. Paul territory in Minnesota.

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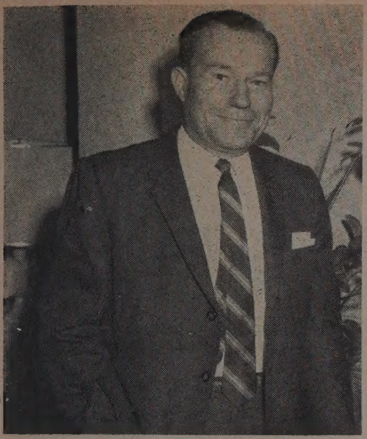

H. B. WHITAKER, Vice Chairman of the NEC correlating committee, New York City, attended the recent Eastern Section IAEI meeting at Portsmouth, N. H., and helped solve some of the tough code problems as a code panel member and moderator.

WEST

Day-Brite Lighting, Inc.: James C. Ramsey, western regional sales manager, located at Santa Clara, Calif.

Federal Pacific Electric Co.: P. K. Donnelly, district manager at Denver, Colo.

Harvey Aluminum: A. A. Gingell Co., San Francisco, Calif., sales representative; J. H. Stumph, manufacturer's representative in the Northwest with offices in Seattle and Portland.

S & C Electric Co.: Fred A. Allehoff, sales engineer for the western half of Washington with offices in Portland.

I-T-E Circuit Breaker Co.: George W. Geiger, manager of Portland district sales office; William V. Knowles, manager of Seattle district sales office.

Keystone Mfg. Co.: Calhoun and Poxon, Los Angeles, Calif., sales representative for southern California and Clark County, Nevada; John Allen Ware and Associates, Phoenix, Ariz., sales representatives for Arizona.

Western Lighting Corp.: Al Griffin, sales representative.

Black & Decker Mfg. Co.: Harold L. Roller, district manager of newly-combined San Francisco-Seattle sales district, Hardware Div.; David S. Stevens, manager of the Seattle service branch.

Georator Corp.: W. Bert Knight Co., Los Angeles, Calif., southern California sales representative.

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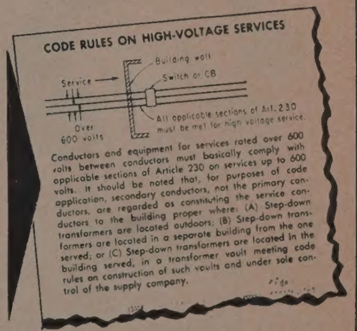

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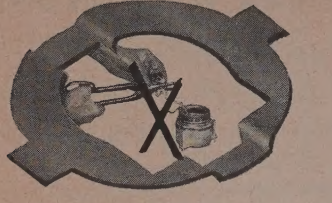

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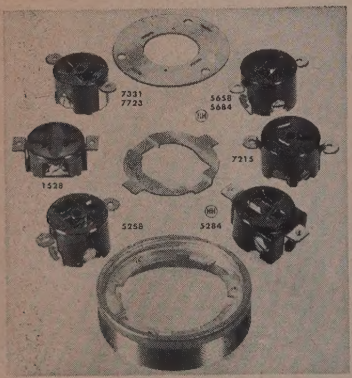

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Acme Steel Co. 14, 15
Adam Electric Co., Frank 93
•Advance Transformer Co. 13
Allen-Bradley Co. 123, 124
Allis-Chalmers Mfg. Co. 99
•All-Steel Equipment, Inc., Raco Div. 6
Amprobe, A Div. of Pyramid Instrument Corp. 105
Appleton Electric Co. 2
•Arrow Conduit & Fittings Corp. 146
Autocall Co., The 153
Autotron, Inc. 148

•Blackhawk Industries 140
Borg-Warner Corp., Pesco Products Div. 101
•Briegel Method Tool Co. 97
BullDog Electric Products Division, I-T-E Circuit Breaker Co. 44
Burndy Corp. 114

•Champion DeArment Tool Co. .. 113
Charles Machine Works, Inc. .. 144
•Circle F Mfg. Co. 78
Circle Wire & Cable, A Subsidiary of Cerro de Pasco Corp. 32
Clark Controller Co. 22
•Collyer Insulated Wire Co. ... 143
Conduit Nipple Mfg. Co. 144
Cornish Wire Co., Inc. 79
Corrosion Reaction Consultants 16
•Crouse-Hinds Co. .....Fourth Cover

•Day-Brite Lighting Inc. 18, 19
•Diamond Expansion Bolt Co., Inc. 140
Dow Corning Corp. 119
Dutch Brand Div., Johns-Manville 27

•Efficiency Electric & Mfg. Co. .. 144
Electrical Construction & Maintenance 155
Electrical Publications Co. 154
Electrical Tubular Products 75
Electri-Flex Co. 151
Erico Products, Inc. 8

Federal Pacific Electric Co. ..10, 11
•Fullman Mfg. Co. 156

•G & W Electric Specialty Co. .. 72
Gamewell Co., The 23
•General Cable Corp. 132, 133
•General Electric Co.
  Apparatus Sales Div. 26, 107, 139
  Wiring Device Dept. 80, 81
Goodrich Chemical Co., B. F. .. 38
•Graybar Electric Co., Inc. 4
Greenlee Tool Co. 94, 95
Guth Co., The Edwin F. ....Second Cover

•Helwig Carbon Products Inc. .. 152
•Henderson-Hazel Corp. 150
•Hose-McCann Telephone Co., Inc. 154

•Ideal Industries, Inc. 30, 31
I-T-E Circuit Breaker Co. 17, 34, 134

Kalamazoo Tank & Silo Co. ... 152
•Keystone Mfg. Co. 120
•Killark Electric Mfg. Co. ..126, 127

Kliegl Bros., Inc. 118

Leviton Mfg. Co., Inc. 84

•Minerallac Electric Co. 154

•National Price Service 150
National Supply Co., Tubular Products Div. 39
National Tube Div. of U. S. Steel 42, 43
National Wiring Bureau 12

Okonite Co., The 137
Onan & Sons Inc., D. W. ..116, 117
Orangeburg Mfg. Co. 36
•O.Z. Electrical Mfg. Co., Inc. .. 20

•Paragon Electric Co. 82
Pass & Seymour, Inc. 74
Permacel 41
•Phelps Dodge Copper Co., Inc. 24, 25
•PLM Products Inc. 131
Plymouth Rubber Co., Inc. ... 35
Pringle Electrical Mfg. Co. 142

Quadrangle Mfg. Co. 130

Ramset Fastening System 76
Republic Steel Corp. 46
Revere Electric Mfg. Co. 109
Ridge Tool Co., The 37
Rohm & Haas Co. 33
•Rome Cable Div. of Alcoa 28, 29, 83
Royal Electric Corp. 141

Schoenenberg, Inc., August 153
•Sierra Electric Corp. 148
•Simplex Wire & Cable Co. 102, 103
Skil Corp. 85
•Sorgel Electric Co. 88
Square D Co. ...Third Cover, 1, 21
Stampings Inc. 148
Standard Transformer Co. 147
Steel & Tubes Div. 46
Steelduct Co., The 77
Sylvania Electric Products, Inc. 128, 129

•U. S. Steel 42, 43
•U-C-Lite Mfg. Co. 151
United States Rubber Co. 71

•Wagner Electric Corp. 40, 149
Western Insulated Wire Co. 121
•Westinghouse Electric Corp.
  Lamp Div. 86, 87
  • Pittsburgh 110, 111
•Wiremold Co., The 145

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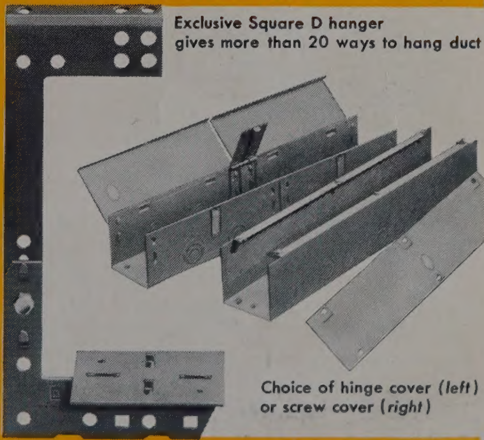

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